Pages 1 to / à 35

are withheld pursuant to sections

sont retenues en vertu des articles

21(1)(b), 13(1)(c), 21(1)(a)

of the Access to Information Act

de la Loi sur l'accès à l'information

Alberta Environment and Parks, South Saskatchewan Region

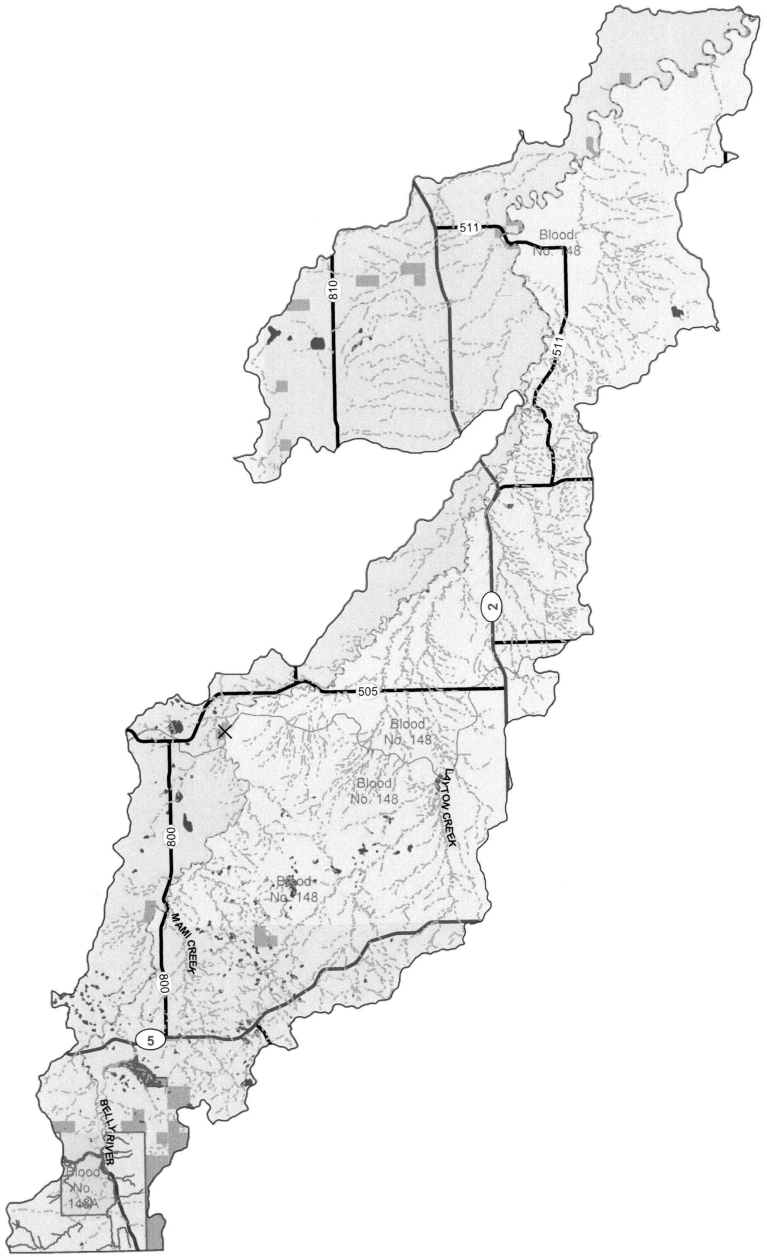
Westslope Cutthroat Trout

BELLY RIVER

HUC 8: 04010301

Map Date: January 10, 2019

0 3 6 12 18 24 30 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

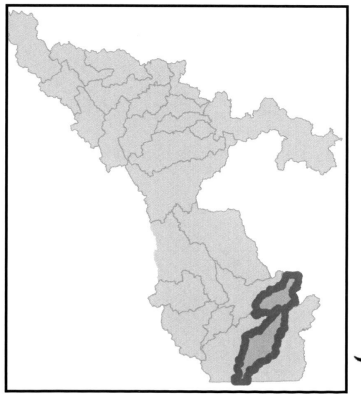
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

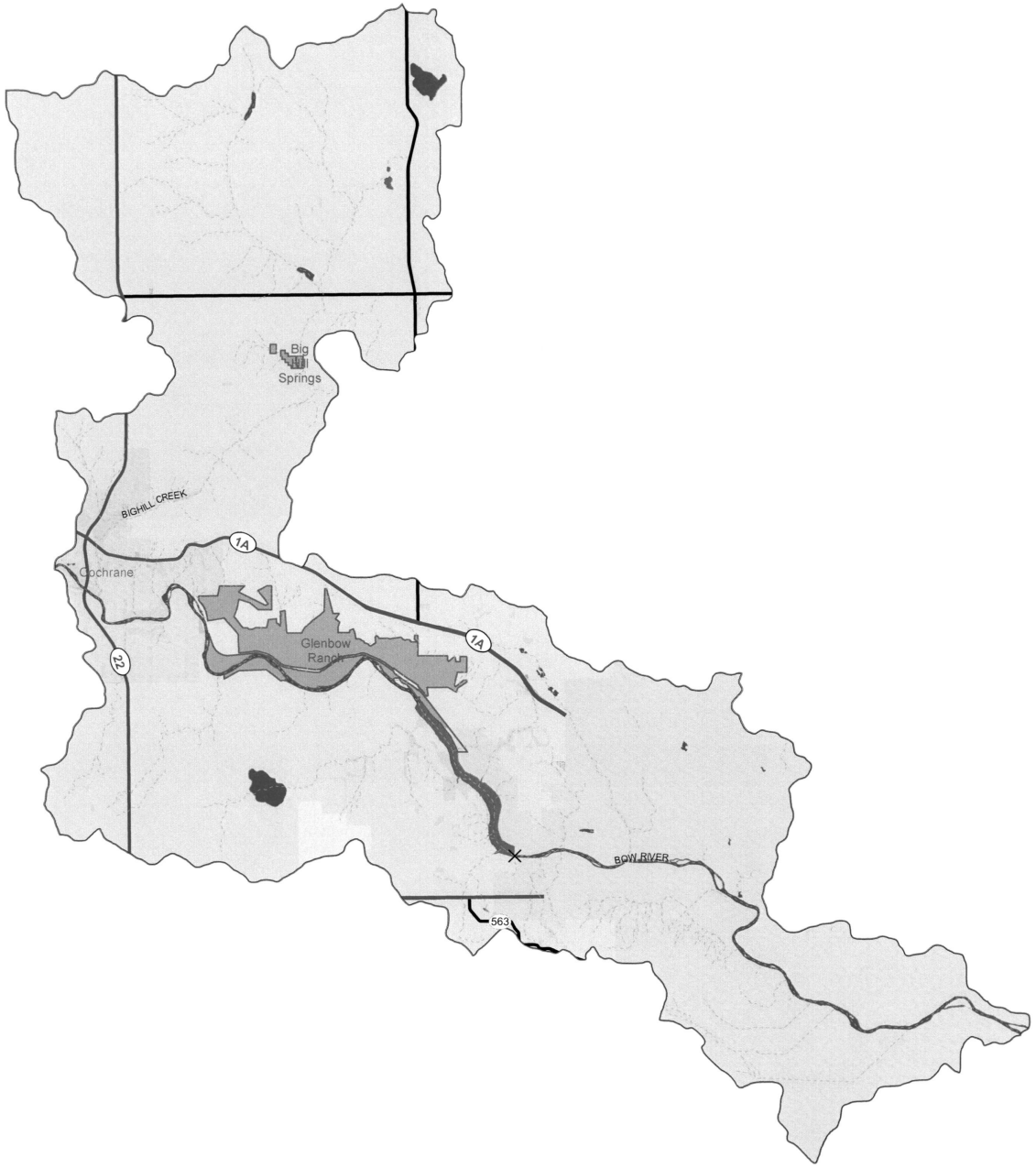


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

BOW RIVER AND BIGHILL CREEK

Map Date: January 10, 2019

HUC 8: 04020801

0 1.25 2.5 5 7.5 10 12.5 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

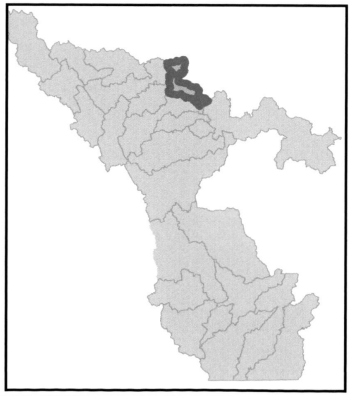
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

BOW RIVER AND GHOST RESERVOIR

Map Date: January 10, 2019

HUC 8: 04020401

0 2 4 8 12 16 20 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

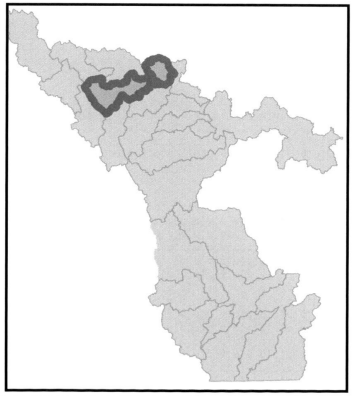
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

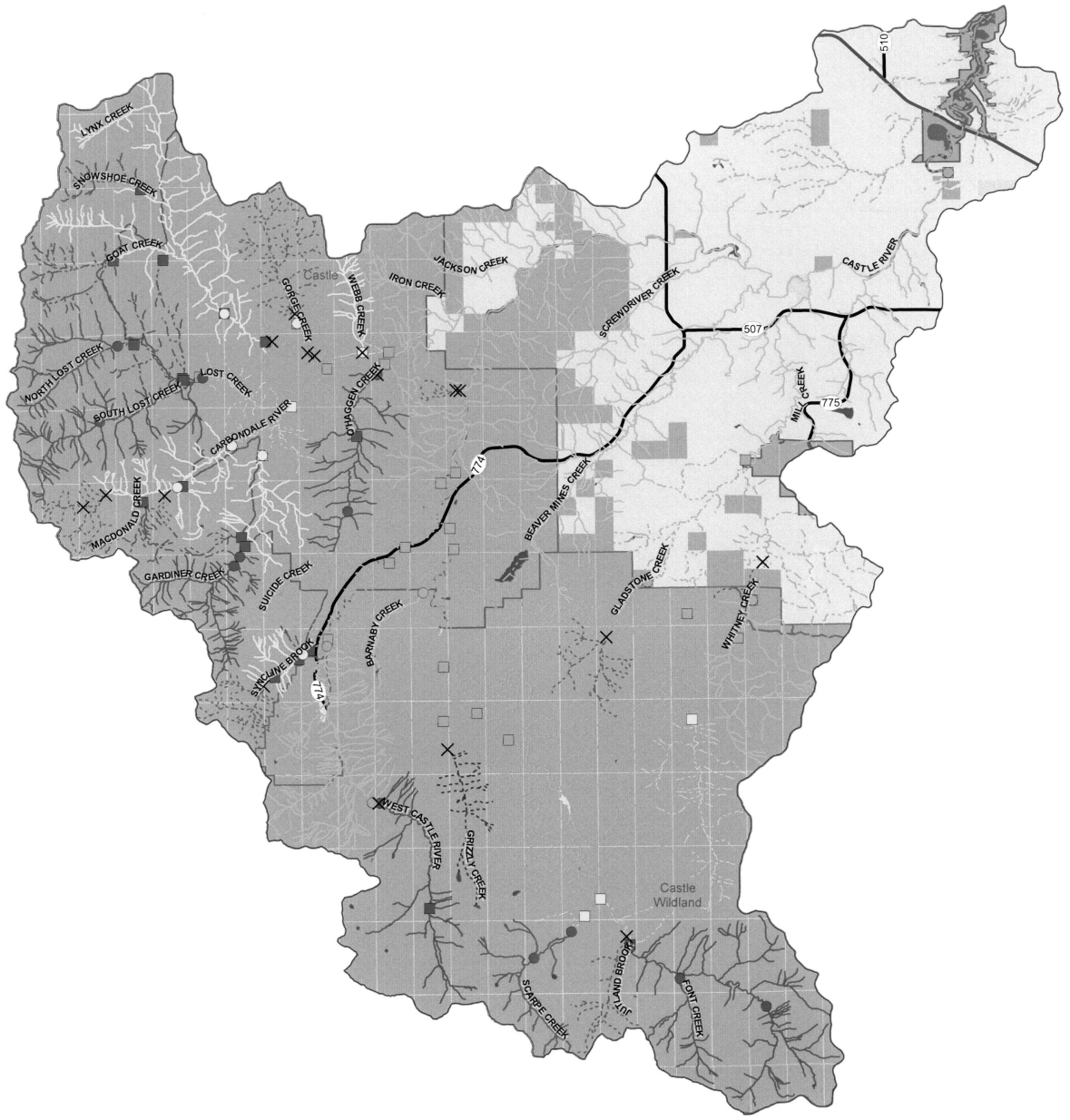


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government 000038

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

CASTLE RIVER

HUC 8: 04010103

Map Date: January 10, 2019

0 1.5 3 6 9 12 15 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

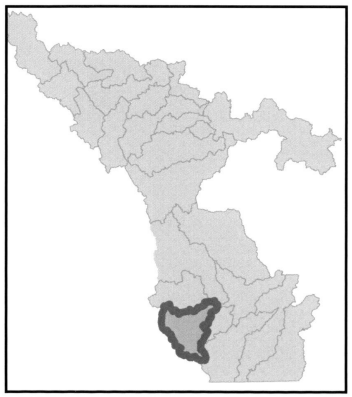
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government 000039

Alberta Environment and Parks, South Saskatchewan Region

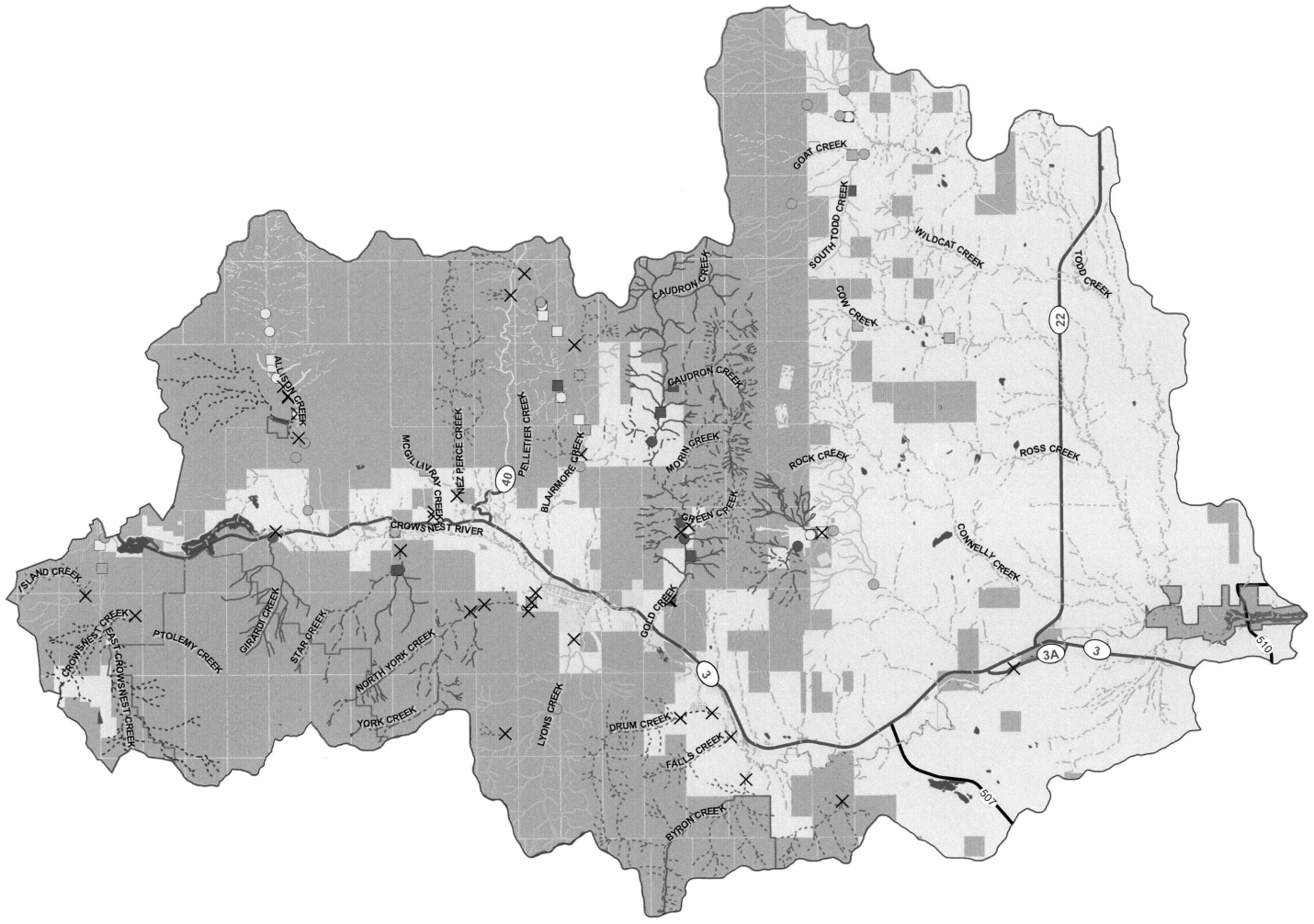
Westslope Cutthroat Trout

CROWSNEST RIVER

HUC 8: 04010102

Map Date: January 10, 2019

0 1.5 3 6 9 12 15 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

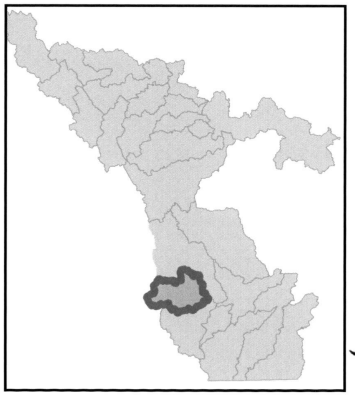
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000040

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

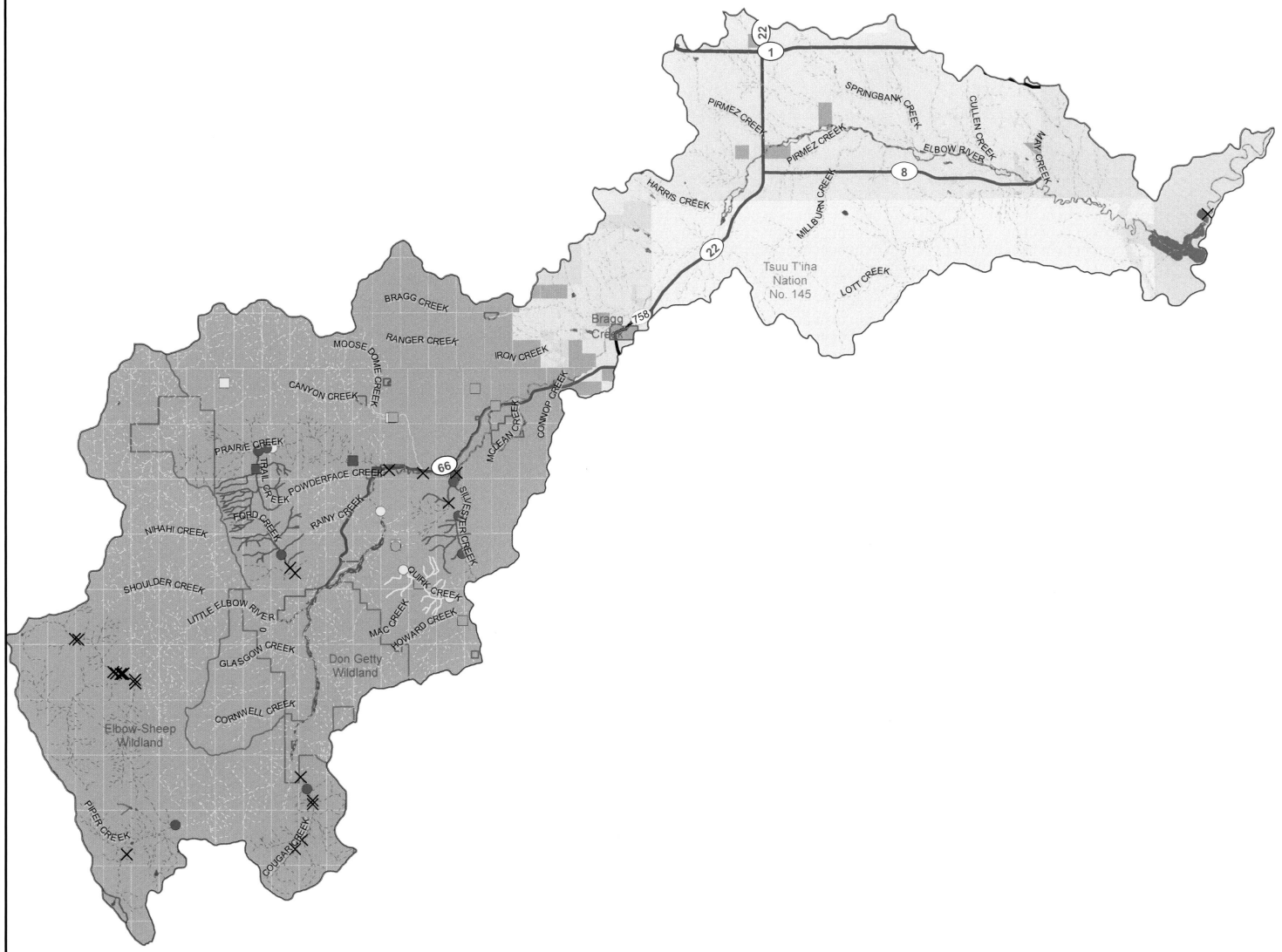
Westslope Cutthroat Trout

ELBOW RIVER

HUC 8: 04021001

Map Date: January 10, 2019

0 2 4 8 12 16 20 Kilometers



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

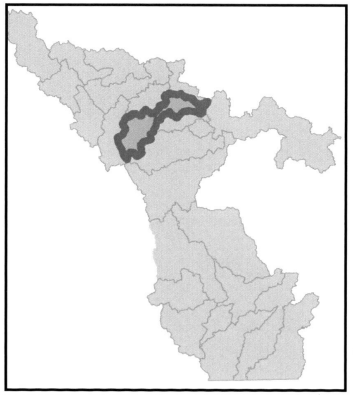
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000041

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

FISH CREEK

HUC 8: 04021101

Map Date: January 10, 2019

0 1.25 2.5 5 7.5 10 12.5 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership
- Federal
- Municipal
- Private
- Provincial

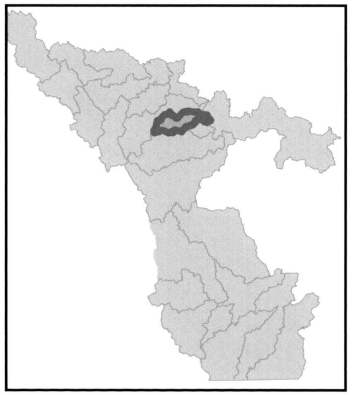
Genetic Purity
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government 000042

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

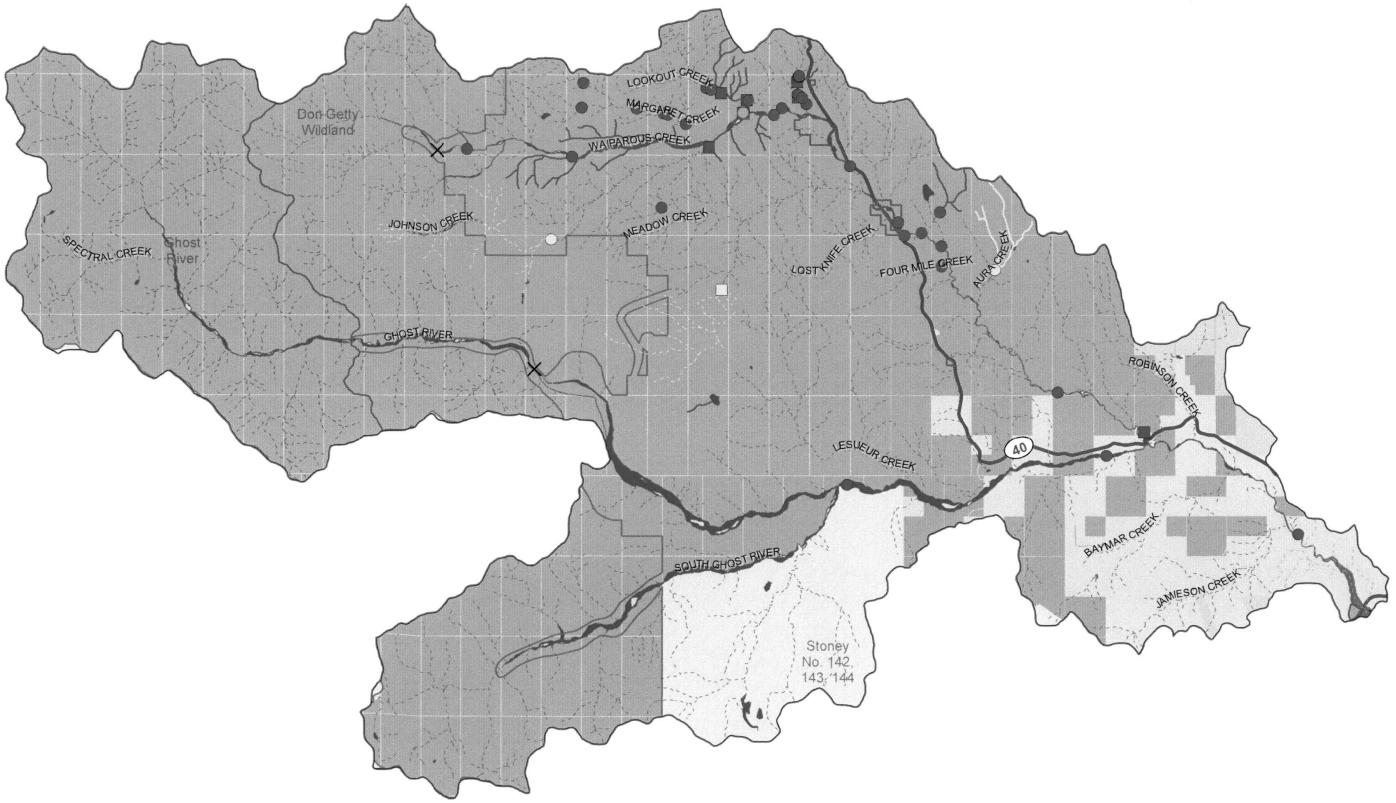
Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout
GHOST RIVER

Map Date: January 10, 2019

HUC 8: 04020701

0 1.75 3.5 7 10.5 14 17.5 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented

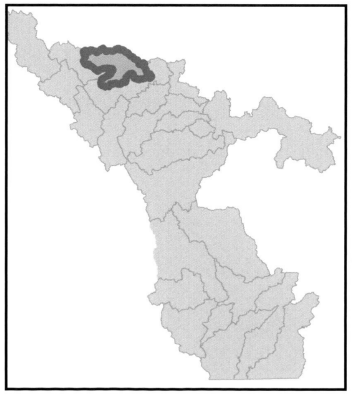
Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

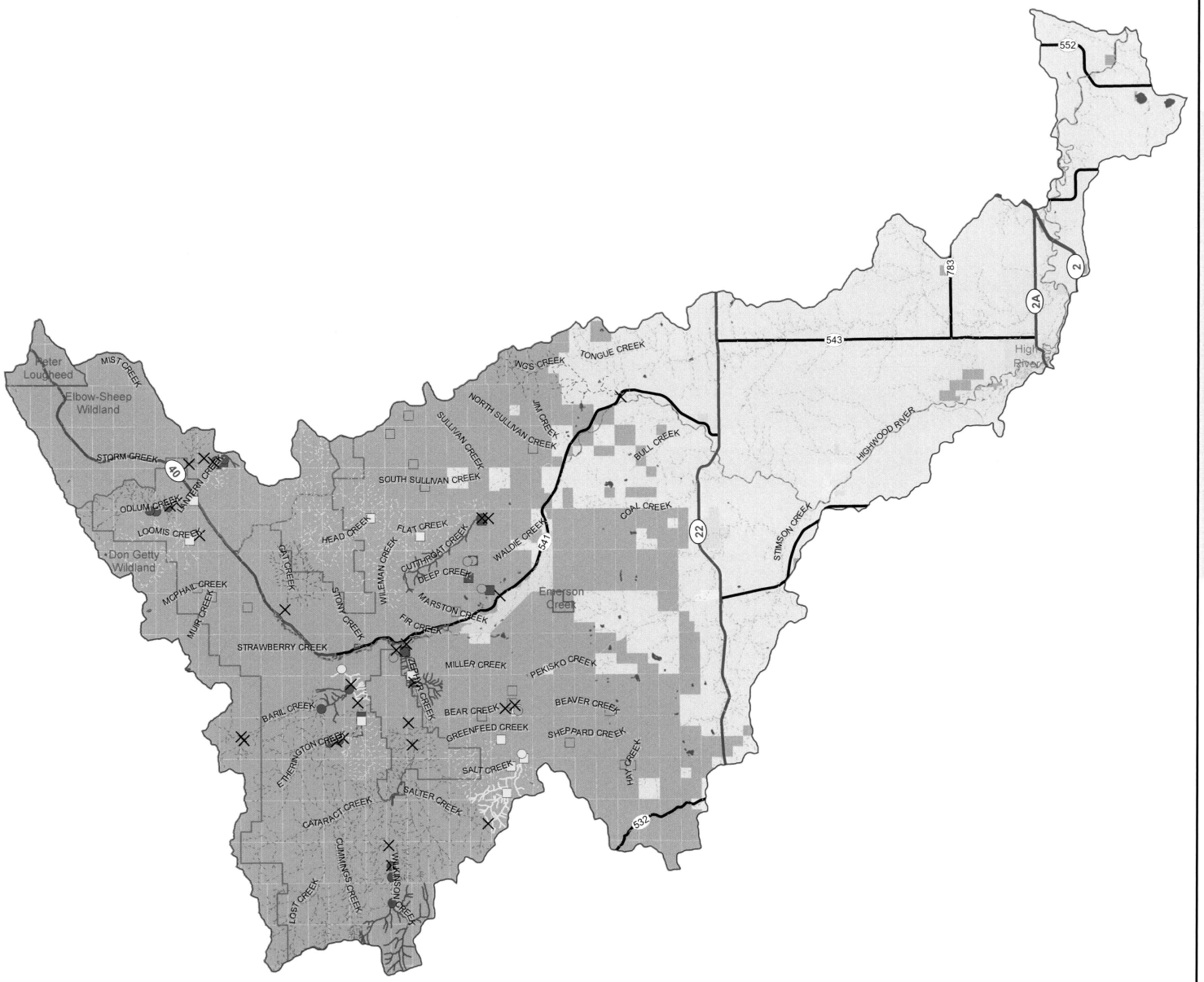


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government 000043

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

HIGHWOOD RIVER

HUC 8: 04021201

Map Date: January 10, 2019

0 2.75 5.5 11 16.5 22 27.5 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

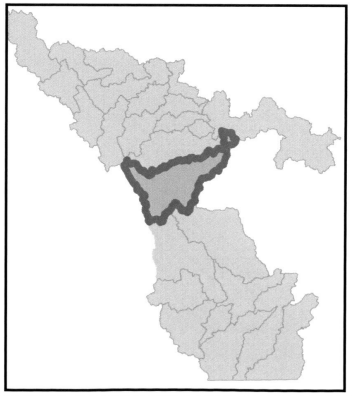
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways — Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Alberta Environment and Parks, South Saskatchewan Region

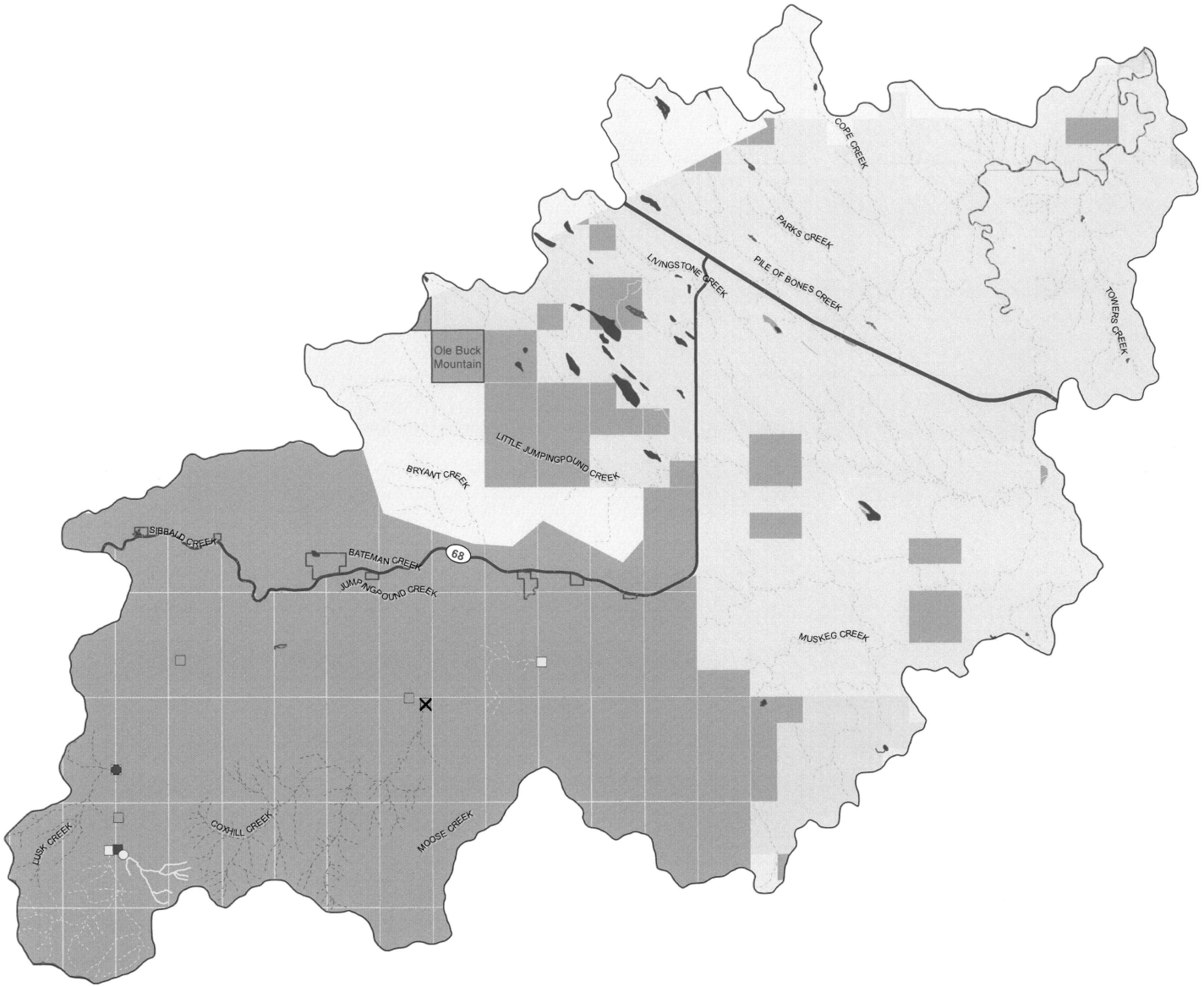
Westslope Cutthroat Trout

JUMPINGPOUND CREEK

HUC 8: 04020802

Map Date: January 10, 2019

0 1 2 4 6 8 10 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

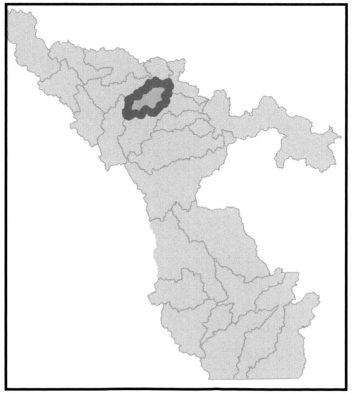
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



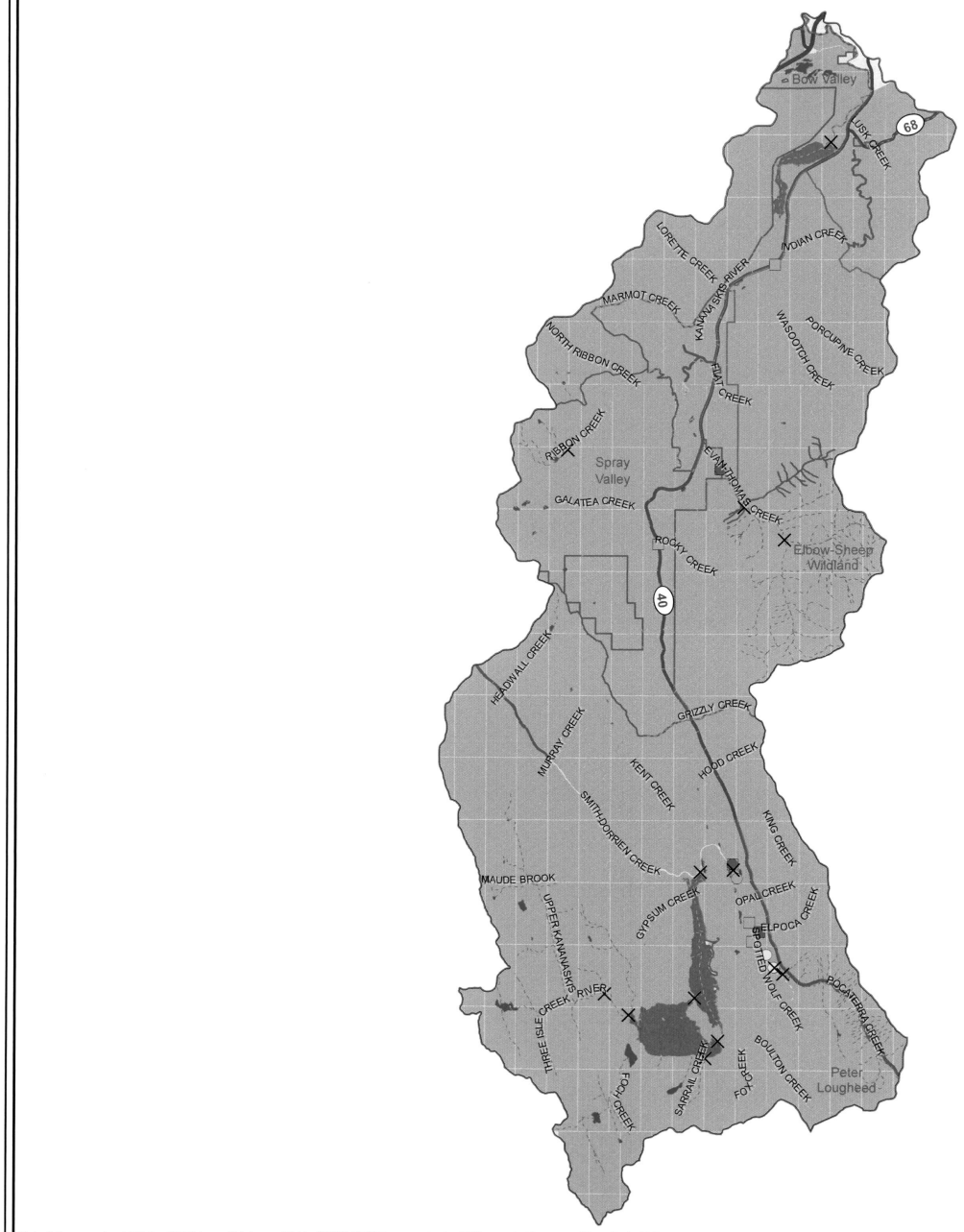
N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000045

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout
KANANASKIS RIVER

HUC 8: 04020601

Map Date: January 10, 2019

0 2 4 8 12 16 20 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

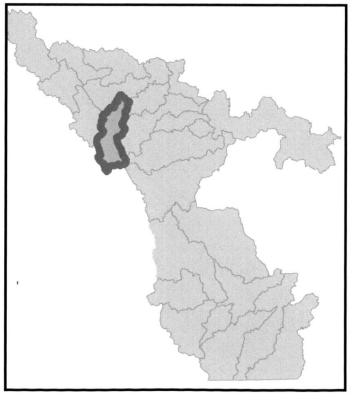
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

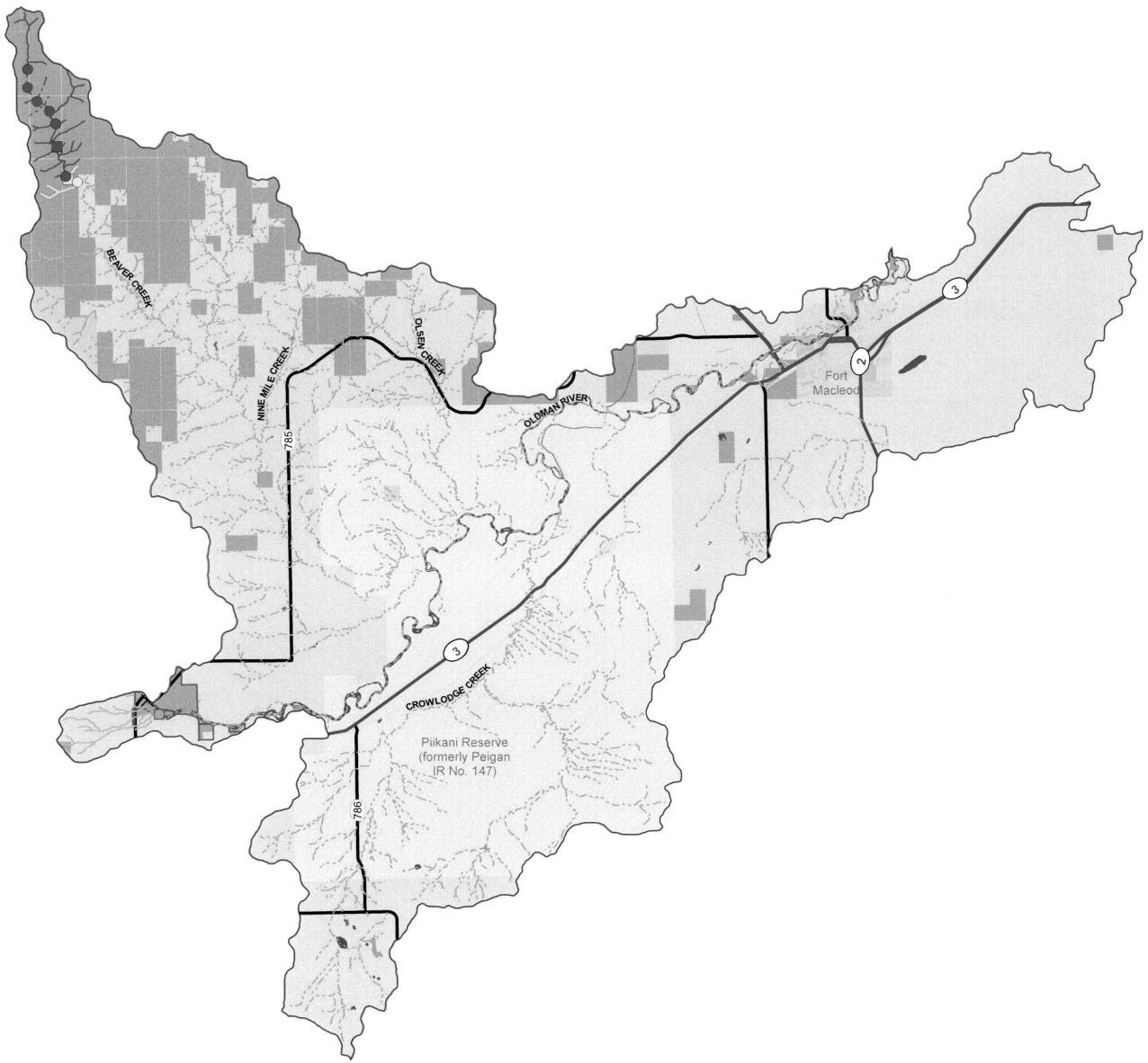
Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

OLDMAN RIVER BELOW OLDMAN RESERVOIR

Map Date: January 10, 2019 HUC 8: 04010105

0 2 4 8 12 16 20 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

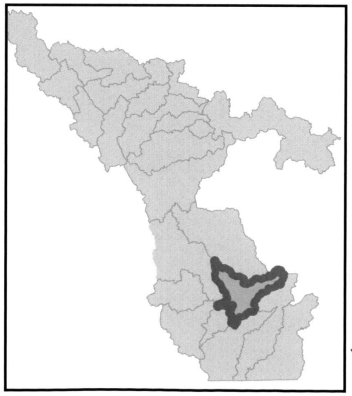
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

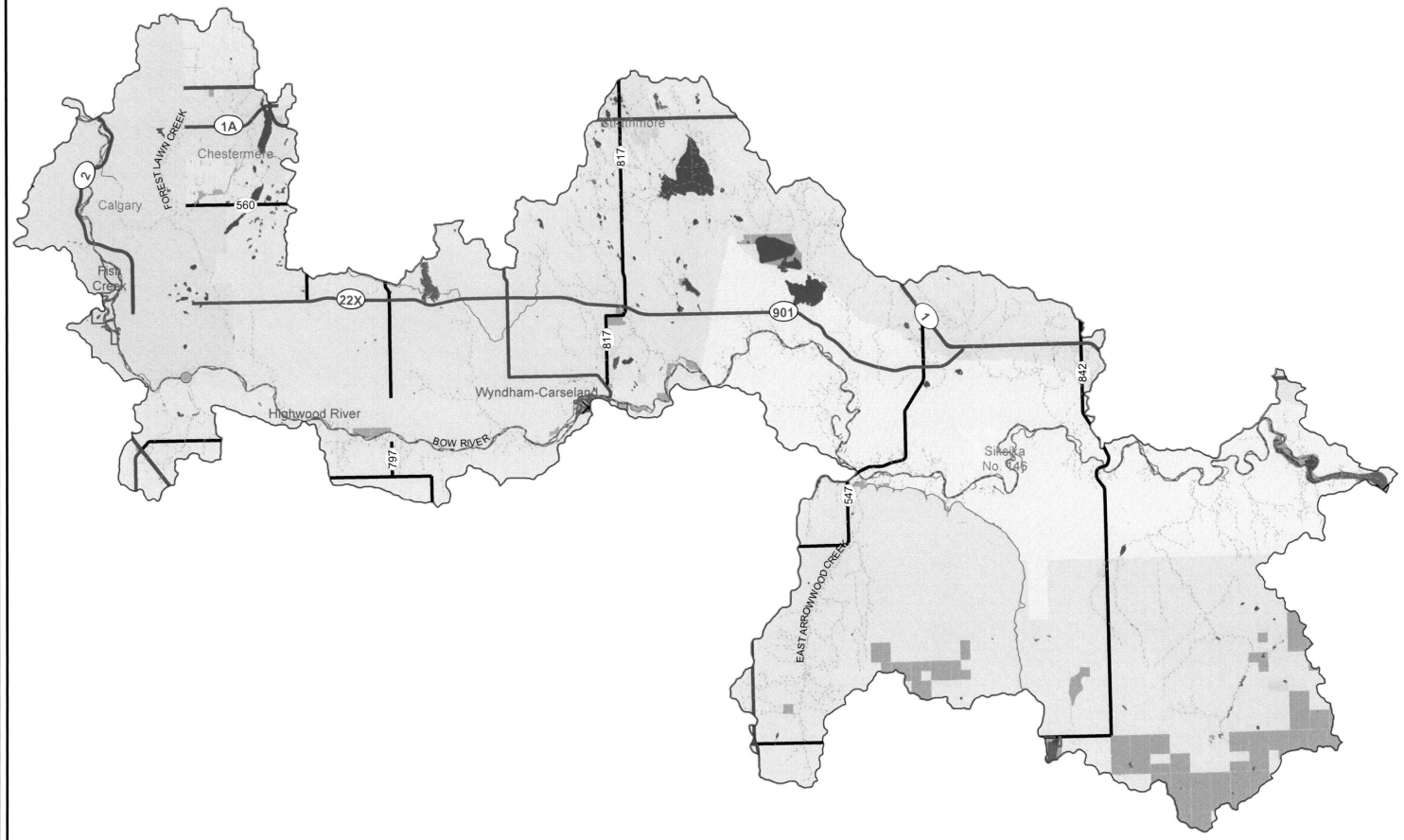
Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout
MIDDLE BOW RIVER

HUC 8: 04020901

Map Date: January 10, 2019

0 3.25 6.5 13 19.5 26 32.5 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

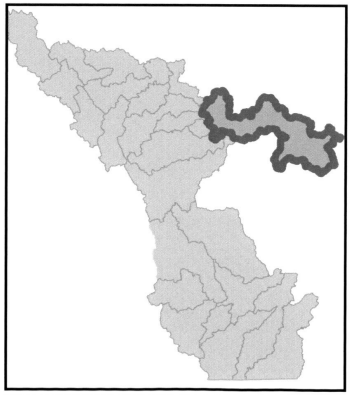
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000048

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

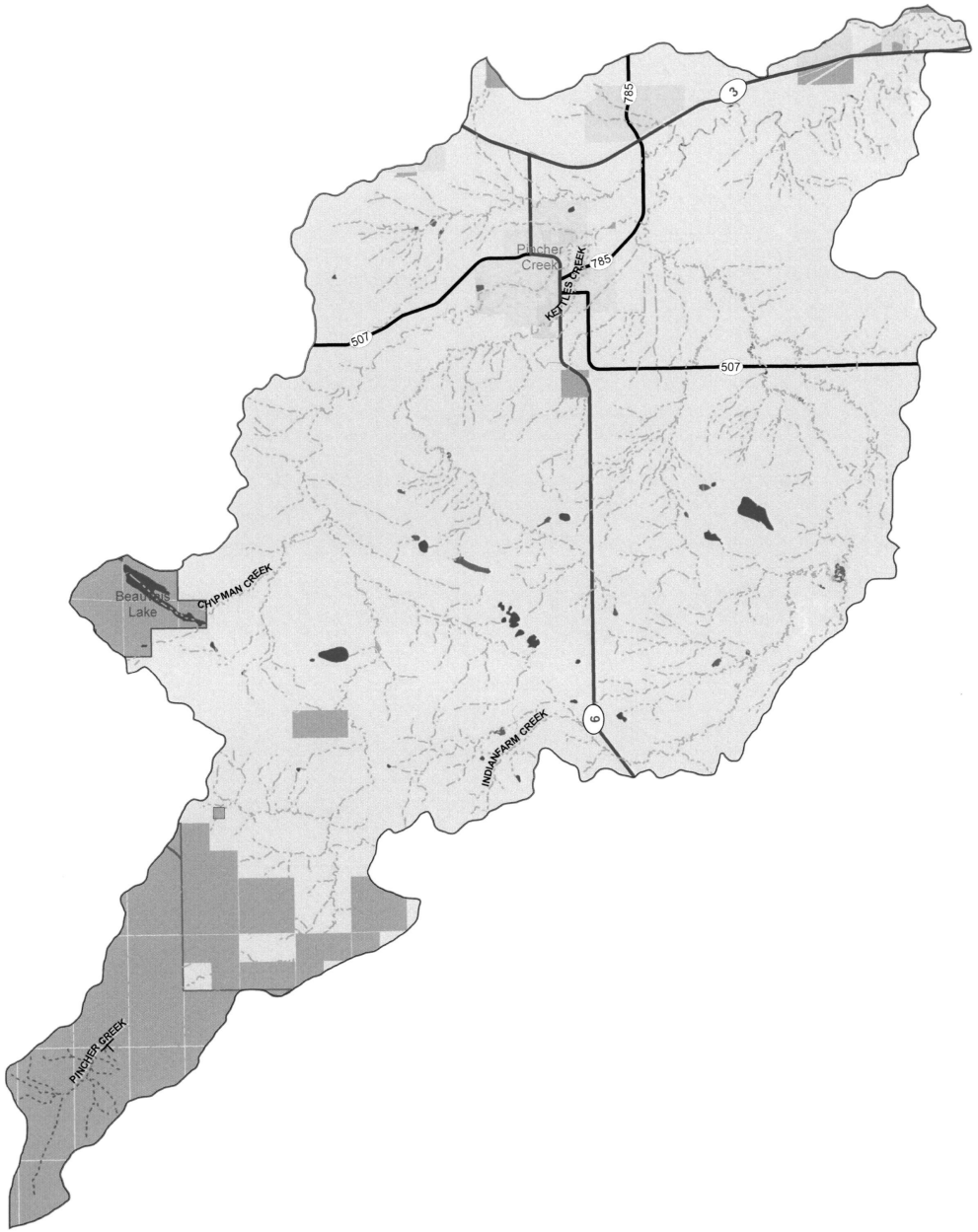
Westslope Cutthroat Trout

PINCHER CREEK

HUC 8: 04010104

Map Date: January 10, 2019

0 1 2 4 6 8 10 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

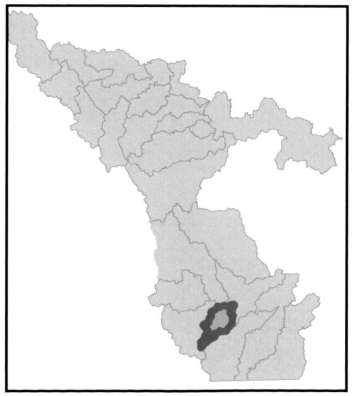
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

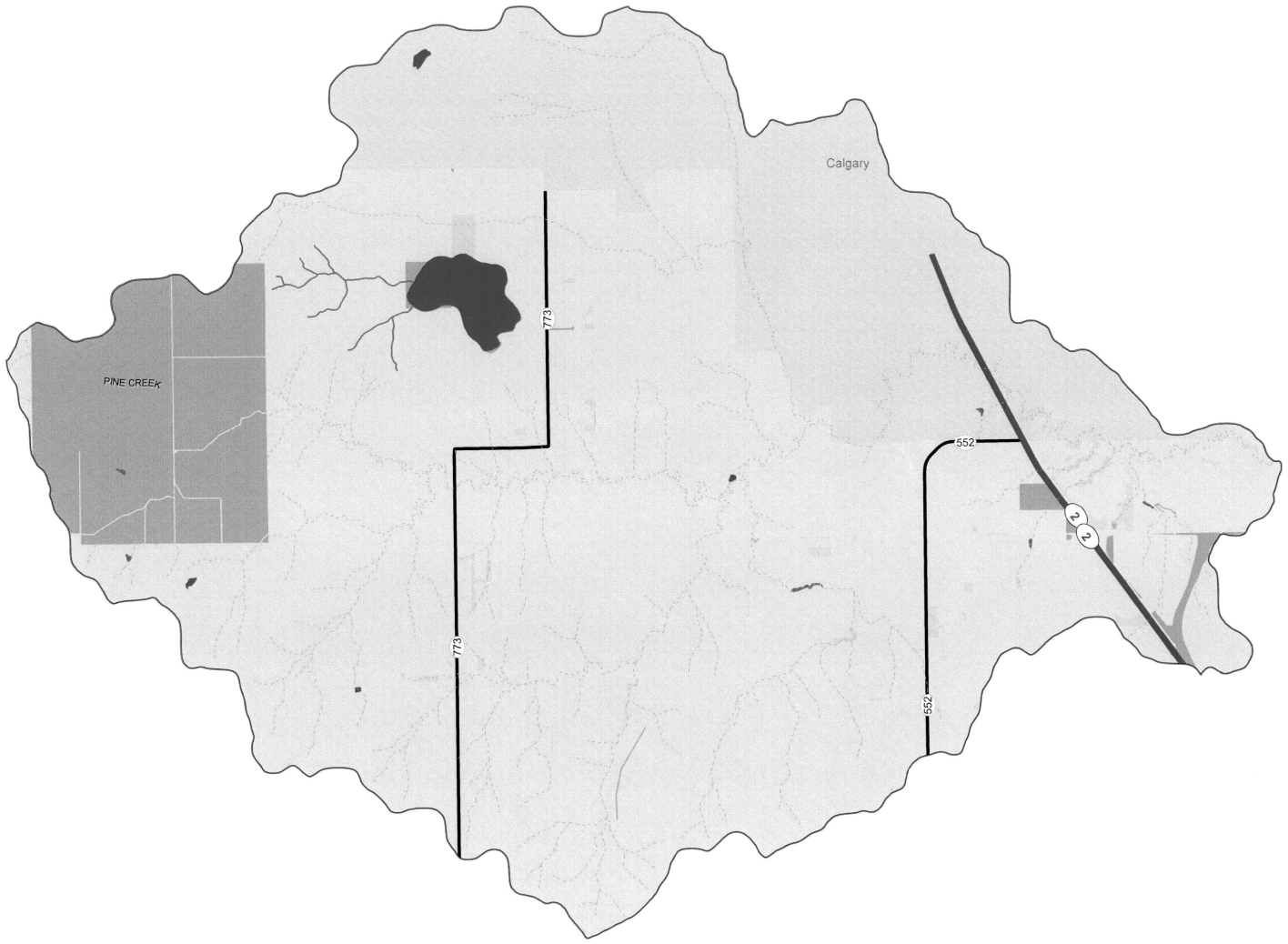
Westslope Cutthroat Trout

PINE CREEK

HUC 8: 04021102

Map Date: January 10, 2019

0 0.5 1 2 3 4 5 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

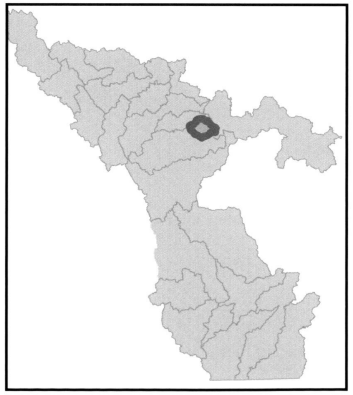
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government 000050

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

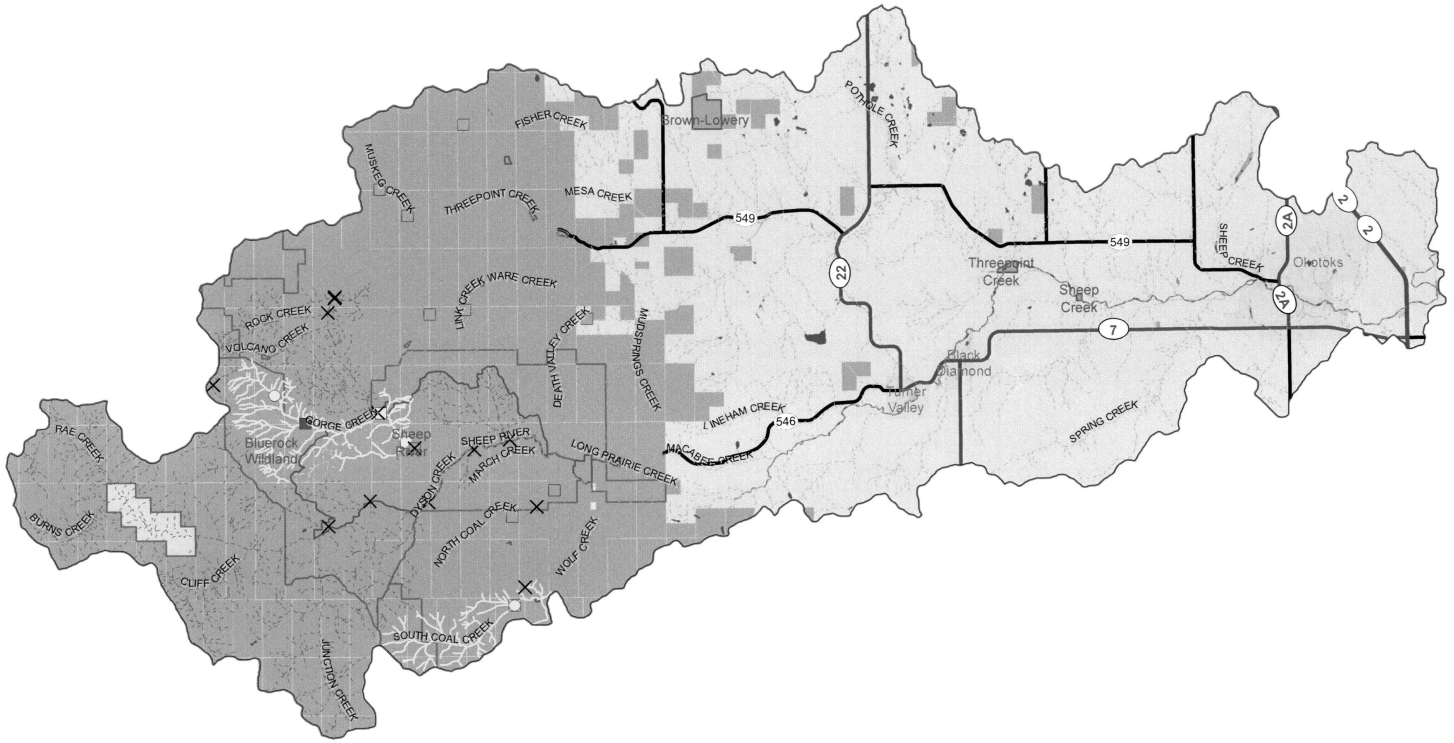
Westslope Cutthroat Trout

SHEEP RIVER

HUC 8: 04021202

Map Date: January 10, 2019

0 2.25 4.5 9 13.5 18 22.5 Kilometers



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented

HUC 8

Permanent barrier to upstream fish movement

National Parks

Provincial Parks and Protected Areas

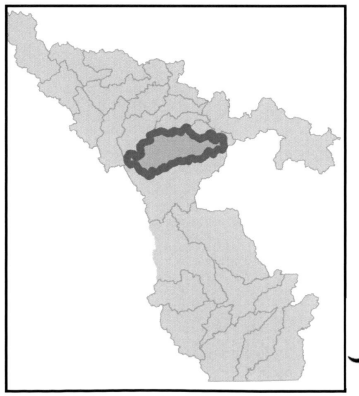
Primary Highways — Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000051

Alberta Environment and Parks, South Saskatchewan Region

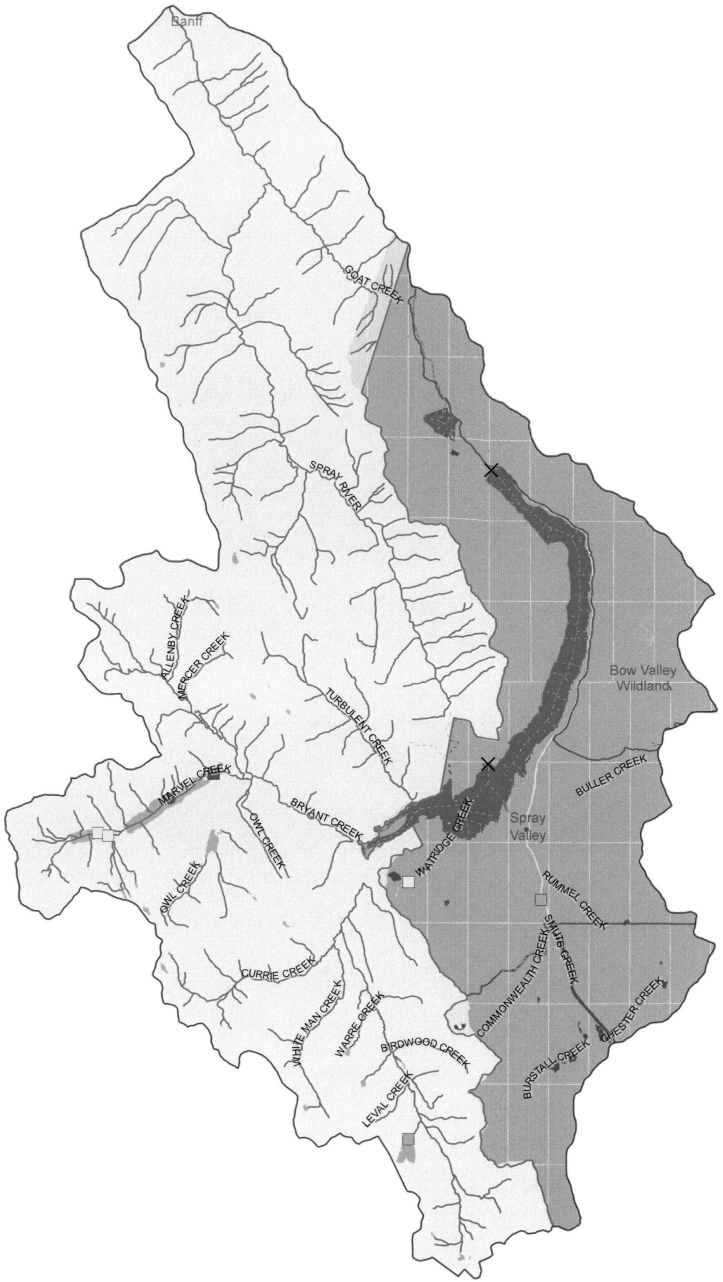
Westslope Cutthroat Trout

SPRAY LAKES RIVER

Map Date: January 10, 2019

HUC 8: 04020301

0 1.75 3.5 7 10.5 14 17.5 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

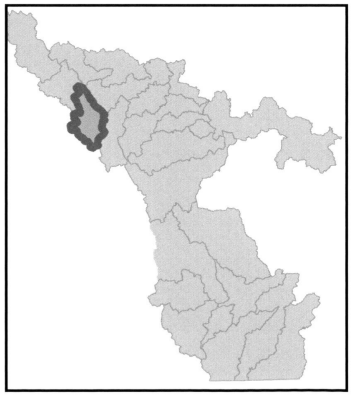
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

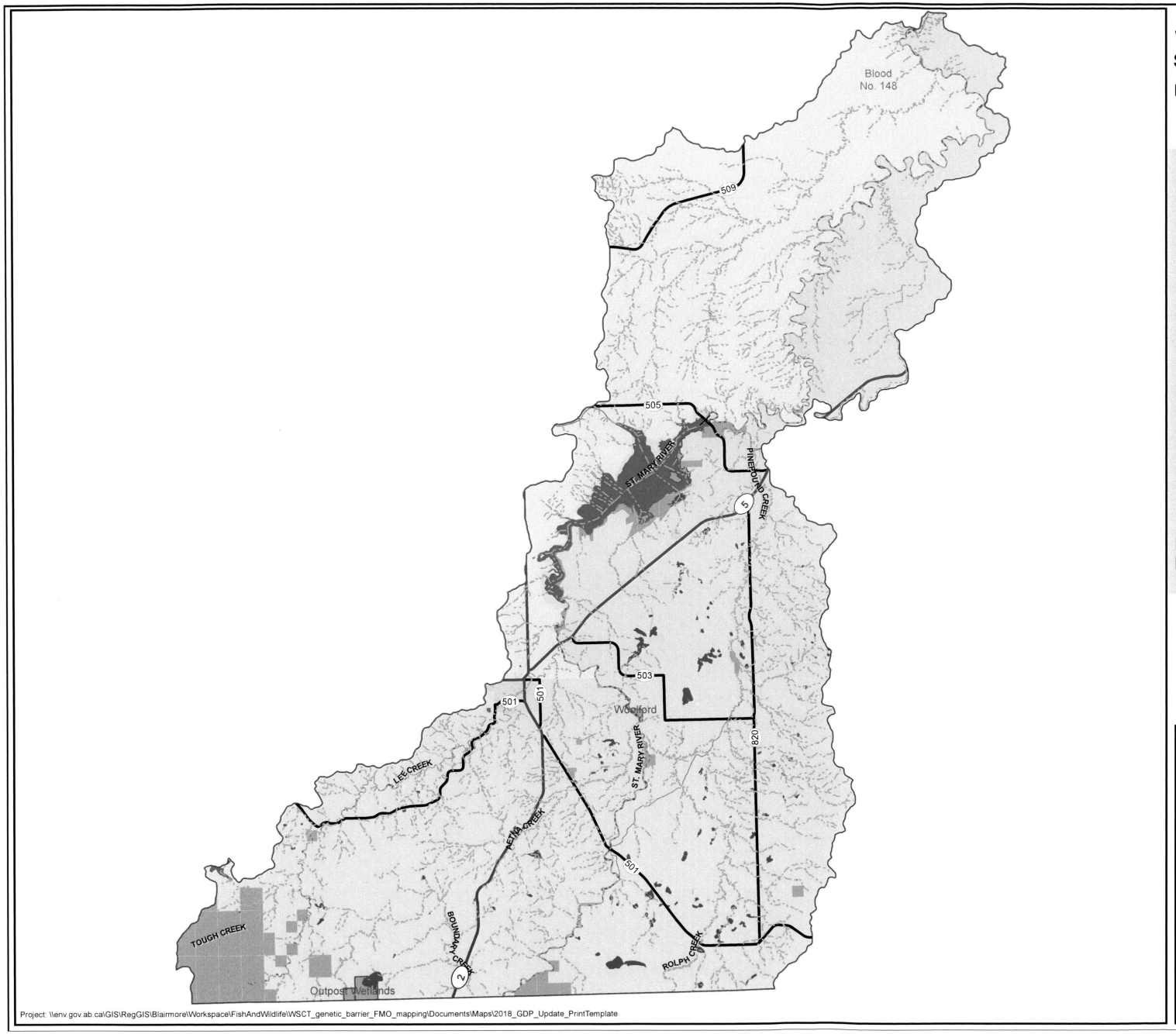


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

ST. MARY RIVER

HUC 8: 04010401

Map Date: January 10, 2019

0 2.25 4.5 9 13.5 18 22.5 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

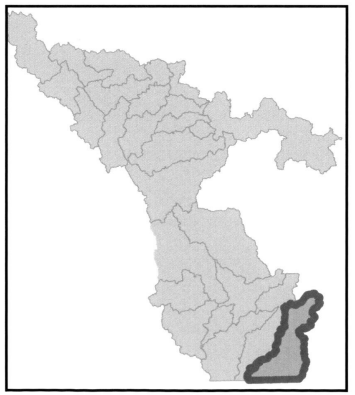
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Alberta Environment and Parks, South Saskatchewan Region

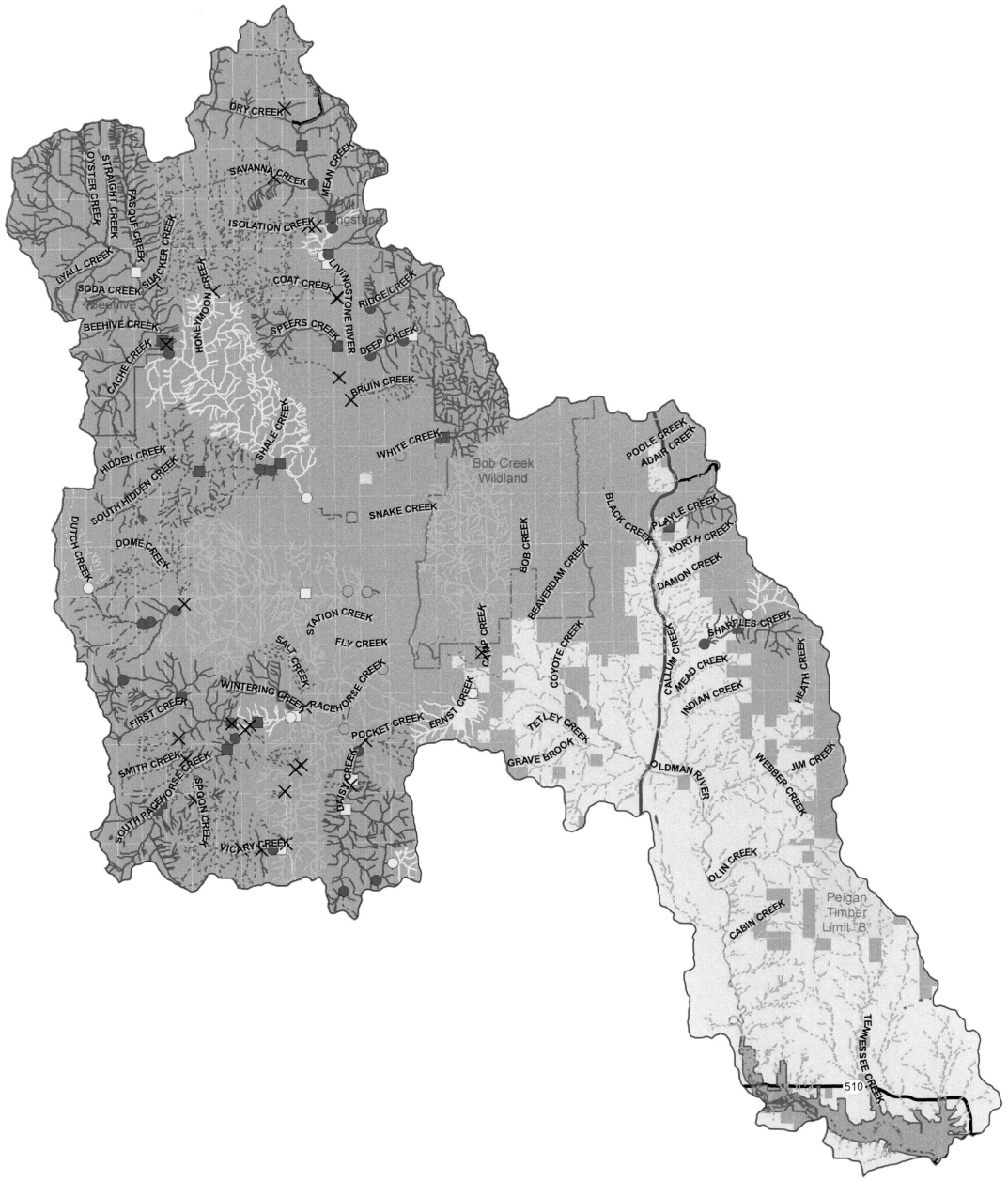
Westslope Cutthroat Trout

UPPER OLDMAN RIVER

HUC 8: 04010101

Map Date: January 10, 2019

0 2.5 5 10 15 20 25 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

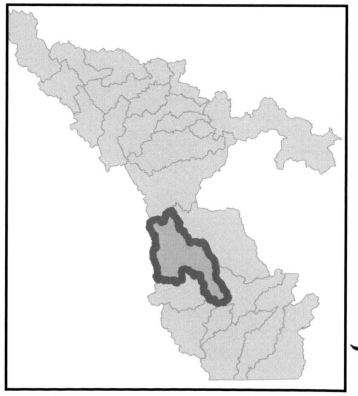
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways — Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Alberta Environment and Parks, South Saskatchewan Region

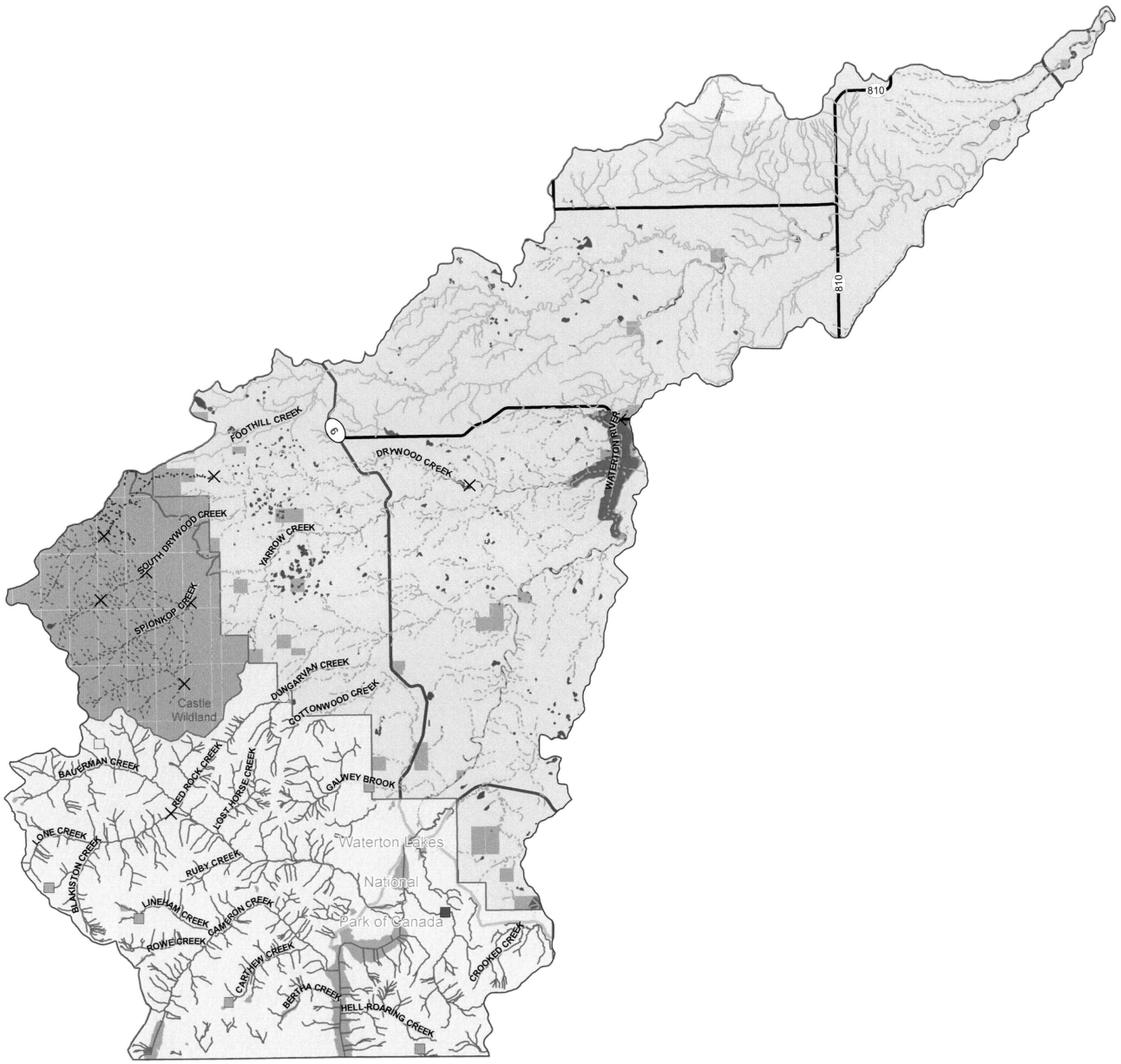
Westslope Cutthroat Trout

WATERTON RIVER

HUC 8: 04010302

Map Date: January 10, 2019

0 2 4 8 12 16 20 Kilometers



Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

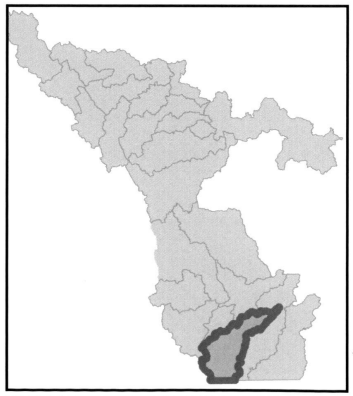
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000055

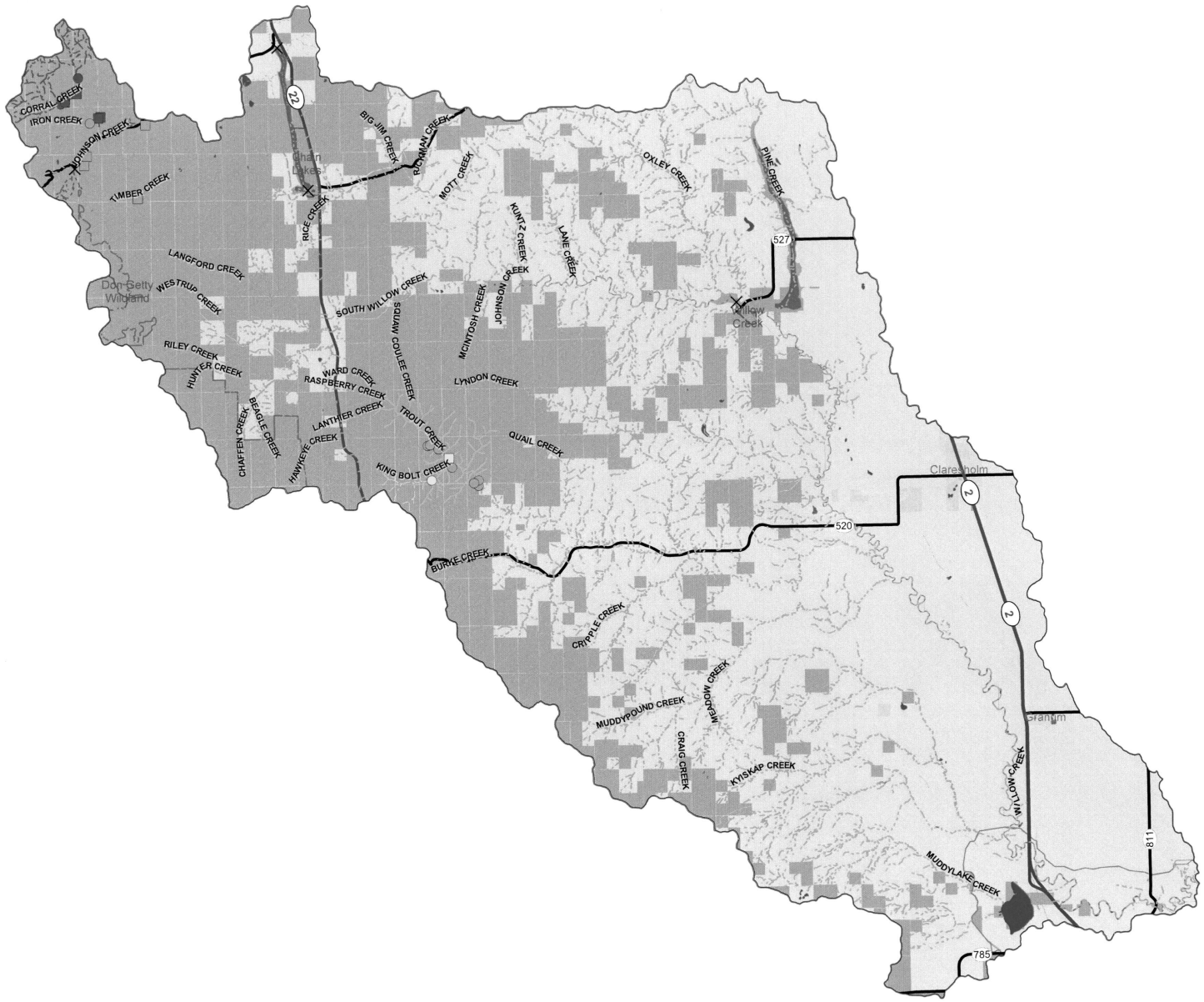
Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout
WILLOW CREEK

HUC 8: 04010201

Map Date: January 10, 2019

0 2.25 4.5 9 13.5 18 22.5 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

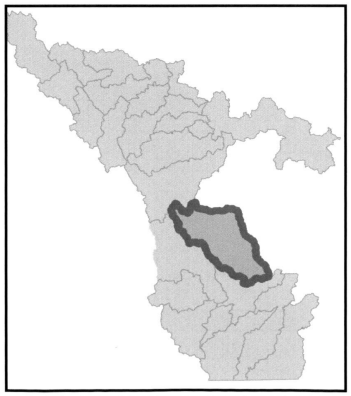
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

000056

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

Lacho, Christine

From: Craig Johnson <Craig.Johnson@gov.ab.ca>
Sent: Tuesday, January 22, 2019 2:15 PM
To: Watson, Ernest
Cc: Paul Christensen; Curtis, Martyn
Subject: FW: Westslope Cutthroat Trout - updated distribution of genetic information
Attachments: AEP Westslope Cutthroat Trout Genetic Delineation Project Summary (draft 11 January 2019).pdf; AEP summary GDP Rule Set Flowchart (draft 11 January 2019).pdf; WSCT_GeneticMappingRuleset_Rev8.docx; 1of21_BellyRiver.pdf; 2of21 _BowBighillCreek.pdf; 3of21_BowGhostReservoir.pdf

Hi Ernie – trying again with more emails of smaller files...

Probably 5 emails in total.

Craig

From: Craig Johnson
Sent: Monday, January 14, 2019 10:42 AM
To: ernest.watson@dfo-mpo.gc.ca
Cc: Paul Christensen <Paul.Christensen@gov.ab.ca>; Martyn Curtis (Martyn.Curtis@dfo-mpo.gc.ca) <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: Westslope Cutthroat Trout - updated distribution of genetic information

Hi Ernie,
As mentioned on my voice mail, I am providing you the most recent maps, and rules used to develop these maps, that describe the genetic distribution of Westslope Cutthroat Trout as of January 2019. As we've discussed previously, these data are not perfect, but represent the best information that we have at this time. If you need some clarification regarding management intent/use (e.g., informing CH, FMOs, etc.), please give me a call. If you or your team (please feel free to share this with your team) have questions about the technical details related to the product (e.g., how it was created, etc.), please contact Paul Christensen.

Our team is now working to develop the necessary context needed to support these maps along with fisheries management objectives that will describe the desired state and objectives related to genetics. We intend to use these maps to inform many items like work plans, habitat-related initiatives, etc. I also plan to release these maps on our website when the necessary context and FMOs have been developed and approved. Let me know if you have any questions on this.

The products provided in this email:

1. "AEP Westslope Cutthroat Trout Genetic Delineation Project Summary (draft 11 January 2019).pdf" – this file summarizes the objective, background, assumptions, a description of how the results were presented in the maps, and other considerations.
2. "AEP summary GDP Rule Set Flowchart (draft 11 January 2019).pdf" – this file summarizes the details of the rules used to assign genetic categories.
3. "WSCT HUC8_2019January10.pdf" – this file contains the draft maps by watershed that depict the current understanding of the genetic distribution of Westslope Cutthroat Trout in their historic range in Alberta.
4. "WSCT_GeneticMappingRuleset_Rev8.docx" – this is the detailed rule set describing and defining how we categorized genetics based on our existing genetic information whether SNP or microsat data.

I decided to provide the two summary documents in addition to the maps to ensure that you had the necessary context for which to understand what the maps were portraying, how they were produced, along with the limitations of the information. We have a much more detailed rule-set that we use to guide the determination and categorization of genetic information that I did not include as I felt that the information provided is an appropriate summary of that document. If you would like to see the detailed rule-set, please let me know, although it will not change the outcome on the maps.

The following are standard caveats we apply to distribution of products like these including, data, maps, and their use:

- The information provided (i.e., maps depicting the genetic distribution of Westslope Cutthroat Trout, the ruleset to develop the maps or ruleset flow chart) should not be considered as a final product, and therefore all are marked as DRAFT;
- These data are only current up to the date of release and are subject to future revisions once new data or information are received by Alberta Environment and Parks;
- While every effort was made to ensure that the data or approaches contained in this product are accurate and up-to-date, Alberta Environment and Parks, its agents and employees are not liable for any loss or damage arising directly or indirectly from the possession, publication, or use of, or reliance on, that information. These products are provided "as is" without express or implied warranty;
- These products may be reviewed or changed as needed at the sole discretion of Alberta Environment and Parks, without notice;
- These products should not be distributed beyond the original recipient, due to the potential for errors or misinterpretation of these products;
- These products should not be relied upon to infer management decisions or management intent on the part of Alberta Environment and Parks or other government agencies;

Thanks and let me know if you have any further questions or require clarification.

Craig

Craig Johnson
Resource Manager

Alberta Environment and Parks, Operations Division
South Saskatchewan Region, Lethbridge

Alberta Environment and Parks

Operations Division, Resource Management, South Saskatchewan Region
January 2019

WESTSLOPE CUTTHROAT TROUT GENETIC DELINEATION PROJECT SUMMARY

Objective

The objective of the *Westslope Cutthroat Trout Genetic Delineation Project* is to create a spatial dataset of Westslope Cutthroat Trout (WSCT) genetic status covering the species' historic native range in Alberta. This Geographic Information System (GIS) dataset categorizes all mapped watercourses based on inferred genetic status of WSCT populations. Genetic status reflects the level of genetic purity of native WSCT, as measured, with respect to hybridization with non-native trout.

Background and Assumptions

Westslope Cutthroat Trout have declined throughout much of their range in Alberta due to overharvest, habitat degradation and loss, introduction of non-native competitor fish species, and hybridization with introduced non-native trout, primarily Rainbow Trout (RNTR) and other non-native cutthroat trout (e.g., Yellowstone Cutthroat Trout). Rainbow Trout and other non-native trout species have been introduced throughout much of native WSCT range, and these species can interbreed with WSCT to produce fertile hybrid offspring. The production of viable, fertile hybrids allows for gradients of genetic purity to occur in populations. Genetic purity is important because it defines the species that have evolved to inhabit southwestern Alberta and, from a legal perspective, it also defines the fish (and populations of fish) that warrant specific measures to protect, conserve, and recover.

The genetic status of populations throughout the species' native range in Alberta has been assessed to indicate the level of purity of native WSCT. In the analysis, the genotypes of microsatellite loci (short sequences of DNA base pairs that are repeated) from reference populations of pure WSCT and RNTR are used to estimate the amount of hybridization present in populations of unknown status. A numerical value is given to each "unknown" fish based on the proportion of loci that originated from WSCT compared to non-native, black spotted trout. This proportion is then assumed to be representative of the total ancestry of the individual, and each fish is scored on a scale of 0 to 1; 0 representing completely non-native black spotted trout, 1 representing 'pure' WSCT.

There are two basic assumptions of the WSCT genetic status mapping project. The first is that hybridization with WSCT generally moves from the lower reaches in watersheds (where stocking predominantly occurred historically and water temperatures are more suited for non-native trout species like RNTR) in an upstream direction, to higher elevation reaches where factors such as colder temperatures, stream gradient, timing of spring freshet and/or physical barriers may play a role in slowing or preventing invasion by non-native trout. The second assumption is that WSCT genetic purity at a sample site also reflects the cumulative genetic status of all WSCT upstream of that location. Stocking of non-native species in the headwater streams or high mountain lakes, and the associated potential for the downstream flow of genetics, was also taken into consideration during the development of this tool.

Methodology

Black-spotted trout tissue samples (in the form of fin clippings) have been, and will continue to be, collected from populations throughout the historic range of WSCT in Alberta. Most sampled

sites have been in headwater streams where pure or near-pure WSCT populations are thought to persist. However, sampling has also occurred, and will continue to occur, on lower mainstem stream reaches based on regional knowledge, physical parameters, and the genetic status assumptions previously described. In general, there will always be more sampling sites in the upper portions of watersheds because downstream reaches are already known to be dominated by established RNTR populations. Some RNTR populations will be specifically targeted to gather information on hybrid source populations that are specific to Alberta. This information is used to determine if hybridization with non-native species is ongoing or the result of historical stocking events.

Some sites have only been sampled once, while other sites have been, or will be, visited more than once. A large number of sample sites require further field assessment, tissue collection, and genetic analysis to determine or update genetic status. Additionally, analysis is required for a number of tissue samples that have already been collected and are waiting for laboratory assessment. To date, tissue samples have been analyzed at Dr. R. Taylor's lab at the University of British Columbia from 2006 to 2011, and at Dr. S. Rogers' lab at the University of Calgary from 2013 to 2015 and Dr. S. Amish's lab at the University of Montana from 2016 to present.

Genetic analysis allows us to genotype (or map out) short sequences of DNA base pairs (loci) that are repeated and unique to each species. These can be compared to known reference populations of pure WSCT and other non-native black spotted trout (RNTR, Yellowstone Cutthroat Trout, Golden Trout and Coastal Cutthroat Trout) to calculate the amount and type of hybridization present. A numerical value is determined for each "unknown" fish based on the proportion of loci that originated from WSCT compared to any non-WSCT species. This proportion is then assumed to be representative of the total ancestry of the individual, and each fish is scored on a scale of 0 to 1; 1 representing 'pure' WSCT, with the number declining as the genetic influence from one or more non-WSCT species increases. The average proportion forms the basis of the genetic categories that are assigned to fish at sampling sites and subsequently assigned to fish in adjacent stream reaches. Average genetic purity scores are separated into three different categories: *pure* (≥ 0.985), *near-pure* (< 0.985 but ≥ 0.945), or *hybridized* (< 0.945). The *pure* category is based on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) guidelines for genetic purity of populations and the *near-pure* category was recommended by the Alberta Westslope Cutthroat Trout Recovery Team in recognition of the potential importance for species conservation and recovery. The *hybridized* category is the default category to describe populations that exhibit lower levels of genetic purity. These categories are represented on the maps as *pure* (green), *near-pure* (yellow), and *hybridized* (orange).

The final GIS stream layers representing WSCT genetic status over the species' native range is produced by plotting the categorized genetic sample sites onto the stream hydrology base layer together with locations of all known impassible fish barriers. This divides the watercourses into discrete segments, which are subsequently assigned a genetic category based on the same categories used for individual sampling locations (i.e., *pure* (green), *near-pure* (yellow), and *hybridized* (orange)). The genetic status of each stream segment is assigned based on a comprehensive set of rules developed for the project. The rules allow genetic status to be assigned to all streams within WSCT native range, regardless of whether or not genetic sampling has occurred, in a consistent and defensible manner. As genetic data are collected from additional sampling sites, results will be used to update and refine the current WSCT genetic delineation mapping product.

Results

GIS layers consist of stream hydrology categorized by WSCT genetic status: i) pure ii) near-pure, iii) hybridized, iv) above barrier – no WSCT documented but other fish species confirmed, and v) above barrier – no fish documented. The GIS layers are available from AEP-SSR Fisheries staff as a File Geodatabase product for use by GOA staff to inform regulatory decisions and strategic land use and conservation planning exercises. These results are also available as Portable Document Format (PDF) maps displaying the layers at the Hydrologic Unit Code (HUC) 8 level.

This dataset will be used to inform the following:

- Identify existing data deficiencies and assist regional Fisheries Staff in work load prioritization
- Inform the development of appropriate, rational, adaptive fisheries and habitat management objectives
- Inform and/or support land use decisions
- Guide, inform, and support federal and provincial species recovery inform and support the WSCT Fish Sustainability Index

Disclaimers and Considerations

The relative breadth of the three genetic categories used in this project should be noted in any assessment of WSCT status. The "pure" and "near-pure" categories represent very narrow bands of genetic status, as only those fish displaying >99% and 99-95% genetic purity fall into these categories. The "hybridized" category is much broader, comprising any proportion of WSCT genetic purity ranging from 94% to near 0%. The "hybridized" category should, therefore, be considered highly variable rather than reflecting a specific level of genetic purity.

It should also be noted that the genetic status of WSCT cannot be mapped with absolute certainty due to the constraints inherent in sampling a limited number of fish at each sampling site. It is not possible to test every fish in a population for genetic status, nor can every stream segment be sampled. Therefore, inferences are made about the genetic purity of larger areas based on samples of fish captured from discrete sites. The ruleset ensures that assignment is made consistently utilizing our best interpretation of existing information on current genetic status. Assignments can, and likely will, change over time as new information is added and as fish populations evolve.

Appendix: Ruleset Flowchart

Helpful Tips:

- Microsatellites were initially utilized for genetic analysis, as this was the best science available at the time. Innovative use of single nucleotide polymorphisms (SNPs) technology has greatly refined our genetic knowledge; therefore, this tool primarily defaults to SNPs information. However, in areas where laboratory results are limited to older microsatellite data, we will still utilize this information as best available data until new genetics data is collected and analyzed.
- Stream segment = continuous stream length, not including tributaries (important when determining which microsatellite data points are overridden by SNP data)
- A genetic point is only used to code stream segments upstream of that point; EXCEPTION – coding between a permanent barrier downstream of a genetic point on the same stream segment
- The genetic category of the hydro layer may only change at a permanent barrier or a genetic sample site
- SNP data always overrides microsatellite data upstream on the same stream segment to the next SNP genetic site

Identify stream segment you wish to code:

1. Determine if stream segment occurs downstream of any genetic sampling points
    a. No, segment is upstream of all genetic sampling points > go to step 2
    b. Yes, segment occurs downstream of a genetic sampling point > go to step 5
2. Identify the number of genetic sites on the stream segment
    a. Zero > go to step 3
    b. One or more > go to step 5
3. Identify the next downstream break
    a. Barrier > go to step 4
    b. Genetic point > go to step 5
4. Use FWMIS records and local knowledge to identify species composition in the stream segment
    a. No records known or available > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'ALL FISH SPECIES STATUS UNKNOWN'**
    b. No confirmed records of WSCT, but other fish species have been captured or observed > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'WSCT STATUS UNKNOWN'**
5. Identify the number of genetic sites on the stream segment
    a. One > go to step 6
    b. More than one > go to step 7
6. Select all stream segments upstream of the identified genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or permanent barrier and/or next upstream genetic point)
    a. If confidence in genetic sampling point is high > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY* - HIGH CONFIDENCE SOLID LINE (high confidence ≥99.6)*** > go to step 8
    b. If confidence in genetic sampling point is low > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY* - LOW CONFIDENCE DASHED LINE (low confidence <99.6)*** > go to step 8
7. Identify all genetic points on the stream segment and their relevance (see Rule 1)
    a. More than one high confidence genetic point > Separately for each point, select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) >

CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY - HIGH CONFIDENCE SOLID LINE** > go to step 8

b. More than one low confidence genetic point > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > go to step 8

****Reminder – override microsatellite points that occur upstream of SNP data points on the same stream segment. Microsatellite data points occurring on separate stream segments (e.g., tributaries) remain valid and can be used for coding.**

c. Both high and low confidence genetic points > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8

8. Identify any permanent barrier(s) on the stream segment, downstream of the genetic point used in coding, but upstream of any additional genetic points
   a. No permanent barrier(s) exist > no changes required
   b. One permanent barrier exists > select all stream segments upstream of the permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP**
   c. More than one permanent barrier exists > select all stream segments upstream of the most upstream permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP** > select all stream segments downstream of the most upstream permanent barrier to the next downstream permanent barrier > **CODE STREAM AND TRIBUTARIES TO **SAME GENETIC CATEGORY USED IN PREVIOUS STEP** - LOW CONFIDENCE DASHED LINE**

Table 1. Mapped WSCT genetic sampling site categories

Category Name	Symbology	Description and definition
Genetically pure	● ■ *	Pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is ≥ 0.985.
Genetically near-pure	● ■ *	Near-pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.985 but ≥ 0.945.
Genetically hybridized	● ■ *	Hybridized genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.945.

*The method of genetic analysis at a sampling site is symbolized with a 'circle' for single nucleotide polymorphisms (SNPs) and a 'square' for microsatellites.

Table 2. Mapped WSCT stream network categories

Category Name	Colour Code	Description and definition
Genetically pure (high confidence)	Solid green	Length of stream that is either upstream of a high confidence pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be ≥ 0.985.
Genetically near-pure (high confidence)	Solid yellow	Length of stream that is either upstream of a high confidence near-pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be <0.985 but ≥0.945.
Genetically hybridized (high confidence)	Solid orange	Length of stream that is either upstream of a high confidence hybridized genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish sampled in this contiguously labeled length of stream is < 0.945. Unlike the pure and near-pure categories above where the assumed genetic purity lies within a narrowly defined range of Q_{WSCT} values, genetic purity can vary broadly in the genetically hybridized category from relatively high (near 95%) to very low (0%).
Genetically pure (low confidence)	Dashed green	Length of stream that is either upstream of a low confidence pure genetic sampling site or between this point and a downstream barrier. This also includes stream lengths with no genetic analysis, but WSCT are known to be present, and a barrier at the downstream end is preventing hybridization. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, the average Q_{WSCT} value (admixture proportion) of fish in this contiguously labeled segment of stream network is still assumed to be ≥0.985.
Genetically near-pure (low confidence)	Dashed yellow	Length of stream that is either upstream of a low confidence near-pure genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is still assumed to be <0.985 but ≥0.945.
Genetically hybridized (low confidence)	Dashed orange	Length of stream that is either upstream of a low confidence hybridized genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is still assumed to be < 0.945.
WSCT Status Unknown	Dashed dark blue	Length of stream with no confirmed records of WSCT, but other fish species have been captured or observed in this contiguously labeled segment of stream
All Fish Species Status Unknown	Dashed purple	Length of stream above a barrier with no confirmed records of any fish species present in this contiguously labeled segment of stream.
Uncategorized	Light blue	Length of stream where either: – WSCT never occurred as part of a functional population within the species' historic range; or, – WSCT are no longer present or may only occur as rare vagrants, and re-establishing a functional population in the short-term is not feasible

WESTSLOPE CUTTHROAT TROUT GENETIC DELINEATION PROJECT- MAPPING RULE SET

OBJECTIVE: To create a spatial dataset of Westslope Cutthroat Trout (WSCT) distribution and genetic status covering the species' entire historic native range in Alberta. This dataset categorizes all mapped watercourses, Strahler first order and above, based on known genetic status of WSCT, where possible, and WSCT presence/absence where no genetic results are currently available. Genetic status reflects the level of genetic purity of native WSCT, as measured with respect to hybridization with the non-native trout. Fish tissue samples (fin clips) are analysed to estimate the proportion of each individual fish genome being WSCT, as opposed to other non-native trout. The average of these admixture proportions (Q_{WSCT}) forms the basis of the genetic categories that are assigned, as outlined below.

The WSCT Genetic Delineation Project (GDP) will consist of geographic information system (GIS) layers spatially representing genetic status (or presence/absence, where genetic data are lacking), and associated measures of data uncertainty. WSCT Fisheries and Habitat Management Objectives based on genetic status, as well as other factors including status and abundance, population integrity and natural and anthropogenic limitations and threats to habitat, are not included in the product, but will be linked to these GIS layers in the future. A generalized version of these data will be summarized and presented as a spatial map product available to internal and external stakeholders to communicate WSCT genetic status.

This dataset will also be used to:

- identify existing data deficiencies and assist regional Fisheries Staff in work load prioritization
- inform the development of appropriate, rational, adaptive fisheries and habitat management objectives
- inform and/or support land use decisions
- guide, inform, and support federal and provincial species recovery
- inform and support the WSCT Fish Sustainability Index

DATA UNCERTAINTY:

Genetic status and WSCT presence/absence cannot be mapped with absolute certainty. Two reasons for this are:

1. For a given site on a stream where a genetic sample is collected, only a subsample of all the fish in that reach is sampled. From this subsample, genetic status in that sample reach (called a sample site) is estimated with some uncertainty. For example, fin clips may be collected from 30 individuals in a 300 m reach of stream. The actual number of fish in that reach is likely much larger than the 30 fish sampled, but just 30 fish are used to estimate genetic status at that site.
2. At the scale of the entire stream network, genetic status from a small number of sample sites is used to infer genetic status over much longer segments of stream upstream and downstream of the sampled site(s). Genetic samples are not collected from these longer segments; genetic status is just inferred. Reaches of stream where genetic samples are collected (sample sites) represent a small subsample of all possible reaches where samples could have been collected and where genetic status is unknown. For example, the genetic status of a 300 m reach of stream may be used to infer the genetic status of 30 km of stream upstream from that reach where no genetic analysis has been performed.

Confidence in genetic admixture detection within a population will vary with sample size, type of analysis method used and age of data. We calculated confidence to detect admixture by using a Binomial power analysis approach:

% confidence = 1-(1-x)^a*b where x = % non-WSCT admixture to be detected
a = number of diagnostic loci used in the analysis
b = number of fish sampled

Due to the nature of hybridization between WSCT and non-WSCT species, biologists have determined that the ability to detect 0.5% hybridization within a population is the benchmark for current SNP analysis; we are currently using 34 diagnostic loci. Stream segments associated with a genetic sampling site in which there is a low confidence (<99.6%) that the sample size has the power to detect 0.5% non-WSCT admixture will be categorized as 'low' confidence (dashed lines). Example:

- If we sample one (1) fish using 34 diagnostic loci (utilizing SNP's) then we are 28.9% confident that we can identify .5% admixture in that individual = **low confidence**.
- If we sample 16 fish using 34 diagnostic loci (utilizing SNP's) we are 99.6% confident that we can identify .5% admixture in those individuals = **high confidence**.

Confidence to detect calculations are not possible for earlier data obtained through microsatellite analysis, as this analysis used non-diagnostic loci. Previously conducted microsatellite analysis will still be used to identify the genetic category stream segments, but these will be categorized as having 'low' confidence (dashed lines) as they utilized non-diagnostic markers.

Information from diagnostic loci are used to address issues concerning the relative amount of divergence among WSCT populations, how genetically different separate populations are from one another. Diagnostic loci are also used for estimating levels of genetic variation, sibling relationships, assignment of fry to parents, as well as estimates of the effective number of breeding adults that produced a year class (review by Kirk & Freeland 2011). When processing genetic results we are looking for polymorphisms. Polymorphisms can mimic hybridization, but diagnostic loci allow us to differentiate natural polymorphisms from hybridization events over time (Allendorf et al. 2004). Using diagnostic loci for genetic analysis is the preferred technique for quantifying hybridization in all subspecies of Cutthroat Trout (Utah Division of Wildlife Resources 2000). Non-diagnostic loci are less informative as they cannot easily differentiate between ancestral polymorphisms and hybridization (Pritchard et al. 2007).

The downstream extent of Cutthroat Trout within the Bow River and Oldman River watersheds was determined using the best available data on the species presence and absence. This information was used to make assessments in areas where genetic information is limited or unknown, and is always labelled with low confidence.

Levels of confidence for genetic status of stream segments are categorized and mapped spatially as 'high' and 'low' as well as recorded in detail in an associated database. The following is a summary of the types of stream segments broadly categorized as having high and low confidence:

High confidence segments (mapped as solid stream lines) include the following:

- Any stream segments that are coded using single nucleotide polymorphism (SNP) tested data in which the confidence in detecting 0.5% genetic admixture is ≥99.6% (i.e. sample sites with ≥16 fish). This includes stream segments:
  - Upstream from a high confidence SNP point to the next upstream extent (all stream orders including Strahler 1st order streams and/or permanent barrier and/or next genetic site)

- Downstream from a high confidence SNP point to a permanent barrier on the same stream segment, providing no other SNP genetic points exist in between

Low confidence segments (mapped as dashed stream lines) include the following:

- Any stream segments that are coded using single nucleotide polymorphism (SNP) tested data in which the confidence in detecting 0.5% genetic admixture is <99.6% (i.e. sample sites with <16 fish), or any stream segments that are coded using microsatellite data. This includes stream segments:
  - Upstream from a low confidence SNP or microsatellite point to the next upstream extent (all stream orders including Strahler 1st order streams and/or permanent barrier and/or next genetic site)
  - Downstream from a low confidence SNP or microsatellite point to a permanent barrier on the same stream segment, providing no other SNP genetic points exist in between
- Segments where WSCT are present, no genetic information exists, but they are suspected pure (generally above physical barriers, although the responsible biologists may believe other types of barriers to upstream hybridization pressure are at play).
- Segments where WSCT or all fish species presence is unknown (see below). Absence of fish is never certain, because it is impossible to adequately sample all habitat, and because fish may occupy the stream segment at times when the stream is not sampled.

Assumptions:

Given that upstream and downstream dispersal of WSCT, non-native trout, and their hybrids occurs continuously, there are two basic assumptions of the WSCT GDP:

1. Hybridization with WSCT is generally moving in an upstream direction from lower reaches in watersheds where stocking initially occurred and water temperatures are more suited for non-native black-spotted trout, such as Rainbow Trout (RNTR), to upper reaches where colder temperatures, as well as other factors like stream gradient and timing of the spring freshet, are excluding or impeding RNTR invasion. This upstream direction of hybridization has been well documented in Alberta (Paul and Post 2001, Rasmussen et al. 2010, Yau and Taylor 2013) as well as other jurisdictions (Fausch et al. 2009, Kovach et al. 2014).
2. WSCT genetic purity at a sample site on a stream reflects the cumulative genetic status of all WSCT upstream of that site. Downstream movement of fish is continually occurring from the entire stream network upstream of that site. Dispersal studies of salmonid movement indicate downstream movement is always occurring, resulting from competition (Elliott 1986, 1990), habitat selection (Gowan and Fausch 2002), or random dispersal (Rodríguez 2010).

Therefore, the genetic results from a specific sampling site reflect both:

- The current amount of hybridization in terms of admixture proportion (Q_{WSCT}) that has reached that point coming from upstream hybridization pressure from fish further downstream
- A cumulative assessment of the overall WSCT genetic status (admixture proportion, Q_{WSCT}) upstream of that site

Due to these two fundamental assumptions, two broad rules apply:

1. The entire stream network upstream of a genetic sample site is categorized based on the category and confidence of that point. This coding is carried upstream until the next upstream extent is encountered, whether that be another genetic point, a migration barrier, or the headwater streams of that system.
2. Category coding from a genetic sample site is only carried downstream on the stream network when a migration barrier exists downstream of the site which limits the upstream movement of fish into the stream segment

In other words, genetic category coding is always carried upstream from a site, unless a permanent migration barrier exists downstream, in which case the genetic category coding is also carried downstream from the point. A detailed rule set is outlined below.

Stream map categories:

WSCT genetic sampling sites (discrete reaches of stream, usually 300m in length, but represented by a single point at the downstream start location) are assigned to the genetic categories in the table below based on genetic data from fin clips collected at each site. There is uncertainty associated with WSCT genetic purity at these sites, because only a subsample of all the fish in the sample site is genetically tested. It is assumed that genetic status is known based on the best available data at these sites, and stream segments throughout WSCT native range are then assigned to these same genetic categories. However, at this stage when genetic purity is assigned to stream segments, data uncertainty is accounted for using solid (high confidence) and dashed (low confidence) stream lines. The number of fin clips successfully analysed at sampling sites and the genetic technique used for analysis are considered in the assignment of stream segments to high and low confidence within each genetic category. A detailed assessment of the uncertainty associated with the genetic status assigned is also recorded qualitatively in the same database used to categorise the stream segments.

To date, genetic data from Dr. Rick Taylor's lab at the University of British Columbia (2006-2011), Dr. Sean Roger's lab at the University of Calgary (2013-2015) and Dr. Steven Amish's lab at the University of Montana (2016 to present) have been used to inform WSCT mapping.

The tables below outline the categories used to:

1. Map genetic sampling sites (points) – Table 1
2. Map stream network categories (color coded stream segments) – Table 2

Table 1. Mapped WSCT genetic sampling site categories

Category Name	Symbology	Description and definition
Genetically pure		Pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is ≥ 0.985.
Genetically near-pure		Near-pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.985 but ≥ 0.945.
Genetically hybridized		Hybridized genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.945.
Samples Not Tested		Fin-clip samples collected from black-spotted trout at sampling site have not been genetically tested.
No Samples Taken		Black-spotted trout were captured or observed at the site, but no fin-clip samples were taken.

No CTTR	⊖	No black-spotted trout captured at sampling site but other fish species were present.
No fish caught	⊘	No fish captured at sampling site.
Dry	⊕	Survey attempted, but not completed because the stream was dry at that time

*The method of genetic analysis at a sampling site is symbolized with a 'circle' for single nucleotide polymorphisms (SNPs) and a 'square' for microsatellites.

Table 2. Mapped WSCT stream network categories

Category Name	**Colour Code**	**Description and definition**
Genetically pure (high confidence)	Solid green	Length of stream that is either upstream of a high confidence pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be ≥ 0.985.
Genetically near-pure (high confidence)	Solid yellow	Length of stream that is either upstream of a high confidence near-pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be <0.985 but ≥0.945.
Genetically hybridized (high confidence)	Solid orange	Length of stream that is either upstream of a high confidence hybridized genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish sampled in this contiguously labeled length of stream is < 0.945. Unlike the pure and near-pure categories above where the assumed genetic purity lies within a narrowly defined range of Q_{WSCT} values, genetic purity can vary broadly in the genetically hybridized category from relatively high (near 95%) to very low (0%).
Genetically pure (low confidence)	Dashed green	Length of stream that is either upstream of a low confidence pure genetic sampling site or between this point and a downstream barrier. This also includes stream lengths with no genetic analysis, but WSCT are known to be present, and a barrier at the downstream end is preventing hybridization. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, the average Q_{WSCT} value (admixture proportion) of fish in this contiguously labeled segment of stream network is still assumed to be ≥0.985.
Genetically near-pure (low confidence)	Dashed yellow	Length of stream that is either upstream of a low confidence near-pure genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is still assumed to be <0.985 but ≥0.945.
Genetically hybridized (low confidence)	Dashed orange	Length of stream that is either upstream of a low confidence hybridized genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions)

Category Name	Colour Code	Description and definition
		of fish in this contiguously labeled segment of stream network is still assumed to be < 0.945.
WSCT Status Unknown	Dashed dark blue	Length of stream with no confirmed records of WSCT, but other fish species have been captured or observed in this contiguously labeled segment of stream
All Fish Species Status Unknown	Dashed purple	Length of stream above a barrier with no confirmed records of any fish species present in this contiguously labeled segment of stream.
Uncategorized	Light blue	Length of stream where either: – WSCT never occurred as part of a functional population within the species' historic range; or, – WSCT are no longer present or may only occur as rare vagrants, and re-establishing a functional population in the short-term is not feasible

RULE SET FOR ASSIGNING GENETIC STATUS TO STREAM SEGMENTS

RULE 1: SNP DATA OVERRIDES MICROSATELLITE DATA ON THE SAME STREAM SEGMENT

Analysis of hybridization in Westslope Cutthroat Trout populations in Alberta began in the early 1980s and broad-scale range-wide monitoring began over a decade ago. The technology to measure hybridization and genetic diversity is rapidly advancing and Alberta has recently transitioned to using more advanced methods consistent with those used in neighbouring jurisdictions (i.e., from microsatellites to single nucleotide polymorphisms, SNPs). In addition, the number of non-native trout species that Alberta's WSCT are being assessed for hybridization with has been expanded beyond just Rainbow Trout (*O. mykiss*), to include Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*), Golden Trout (*O. mykiss aguabonita*), and Coastal Cutthroat Trout (*O. clarkii clarkii*). As such, the genetic data available at a given sampling location can vary with respect to the age of data, analysis method used and species assessed for hybridization. Prior to 2016, all genetic analysis was conducted using non-diagnostic microsatellite markers. Since 2016, single nucleotide polymorphism (SNP) analysis using diagnostic loci has been used to assess hybridization in Alberta's WSCT populations. The varying accuracy and confidence in the detection of non-WSCT genetics between microsatellite and SNP analysis has culminated in a hierarchy of genetic results (Table 3).

In instances where repeated genetic samples have been collected along a stream segment, the most recent sample analyzed with the most advanced genetic technique (currently, single nucleotide polymorphisms) will be used to assign the genetic category to this reach of stream. To ensure consistent and repeatable application of this rule, the following guidance with respect to data quality (genetic technique, sample sizes, power to detect, and level of admixture) will be applied to determine which genetic data should be used when applying the remaining ruleset to delineate genetic status (Table 3).

Table 3. Rank of the confidence of genetic results based on the type of analysis and sample size.

Confidence Ranking	Analysis Type	Sample Size	Coding Procedure
High (≥99.6% confidence in detecting 0.5% non-WSCT admixture)	SNP (diagnostic markers)	≥16 fish	All points considered – code associated arc(s) as high confidence (solid line)
Low (>0 - <99.6% confidence in detecting 0.5% non-WSCT admixture)	SNP (diagnostic markers)	<16 fish	All points considered – code associated arc(s) as low confidence (dashed line)
Minimum (confidence in detecting 0.5% non-WSCT admixture could not be calculated with non-diagnostic markers)	Microsatellite (non-diagnostic markers)	>0	Consider points if they are the only available data for the stream segment. If SNP data exists downstream on the same segment, defer to SNP results and disregard microsatellite point. Code associated arc(s) as low confidence (dashed line). *Note: If samples were initially tested with microsatellite analysis, then retested with SNP analysis, defer to SNP results.

- Rule applies to all areas and situations. Before coding stream using any of the following rules, it must first be determined if any microsatellite data is overridden by SNP data. Microsatellite data is overridden by SNP data and must be disregarded in any of the following circumstances:
    - Microsatellite genetic point occurs upstream from a SNP genetic point (high or low confidence), on the same stream segment (i.e. continuous stream length, not including tributaries)
    - A SNP point on a mainstem segment does not override microsatellite data on an associated tributary, when the microsatellite are the only data available on the tributary
    - Microsatellite genetic point occurs upstream from a permanent barrier, but downstream from a SNP genetic point (low or high confidence) on the same stream segment (i.e. continuous stream length, not including tributaries)

Bow River watershed examples:

- Zephyr Creek in the Middle Highwood River watershed (HUC 0402120103) between permanent barriers B_B028 and B_B111, the pure SNP tested genetic site ZEP-01 (100% confidence to detect 0.5% genetic admixture) overrides the two microsatellite points J-H18 (pure) and J-H18d (near pure). All streams and tributaries are coded to the high confidence pure category.
- Quirk Creek in the Upper Elbow River watershed (HUC 0402100101) upstream from the near pure SNP tested genetic site upper reach (49.4% confidence to detect 0.5% genetic admixture) to the headwater streams, where the SNP data overrides microsatellite point J-E20f (hybridized). All streams and tributaries are coded to the low confidence near pure category.

Oldman River watershed examples:

- Syncline Brook in the West Castle River watershed (HUC 0401010302) upstream from the near pure SNP tested genetic site Syncline1 (100% confidence to detect 0.5% genetic

admixture) to the barrier B_O110, where the SNP data overrides the microsatellite point ACA-37 (pure). All streams and tributaries are coded to the high confidence near pure category.

- Gold Creek in the Gold Creek watershed (HUC 0401010204) upstream from the pure SNP tested genetic site Gold4 (100% confidence to detect 0.5% genetic admixture) to the headwater streams, where the SNP data overrides the microsatellite point GC13BP (pure), but does not override the microsatellite point Cau15BP, which exists on Caudron Creek, a tributary to Gold Creek. All streams and tributaries, except Caudron Creek upstream from point Cau15BP, are coded to the high confidence pure category.

RULE 2: STREAM SEGMENTS ARE CODED TO HIGH CONFIDENCE, SOLID LINES WHEN THE SOURCE POINT IS A HIGH CONFIDENCE SNP GENETIC SAMPLING POINT

Stream segments that are coded using the data from a high confidence (≥99.6% confidence in detecting 0.5% non-WSCT genetic admixture) genetic sampling point are labelled with high genetic certainty (solid line), with the category matching the genetic sampling point.

- Rule applies to the stream and tributaries upstream of the genetic sampling point to the next upstream extent, whether that is another genetic sampling point, permanent barrier, or headwater streams.
- Rule applies to the stream and tributaries downstream of the genetic sampling point to a permanent barrier on the same stream segment, only if no other SNP genetic sampling point exists between the point and the barrier.

Bow River watershed examples:

- Ford Creek in the Upper Elbow River watershed (HUC 0402100101) upstream from the permanent barrier B_B084 to the headwater streams, code all streams and tributaries to the high confidence pure category based on the pure SNP tested genetic site FRD-3 (100% confidence to detect 0.5% genetic admixture).
- Silvester Creek (in the Middle Elbow River watershed (HUC 0402100103)) upstream from the permanent barrier B_B021 to barrier B_B005 and genetic point S9, code all streams and tributaries as high confidence pure category based on the two SNP tested genetic points. SNP's points S18 (pure, 100% confidence to detect 0.5% genetic admixture) and S15 (pure, 99.7% confidence to detect genetic admixture).

Oldman River watershed examples:

- Daisy Creek in the Racehorse Creek watershed (HUC 0401010106) upstream from the near pure SNP tested genetic site DS4 (99.9% confidence to detect 0.5% genetic admixture) all streams and tributaries are coded to the high confidence near pure category.
- Todd Creek in the Todd Creek watershed (HUC 0401010207) upstream from the hybridized SNP tested genetic site Todd1 (100% confidence to detect 0.5% genetic admixture) all streams and tributaries are coded to the high confidence hybridized category.

RULE 3: STREAM SEGMENTS ARE CODED TO LOW CONFIDENCE, DASHED LINES WHEN THE SOURCE POINT IS A LOW CONFIDENCE SNP OR MICROSATELLITE GENETIC SAMPLING POINT

Stream segments that are coded using the data from a low confidence (<99.6% confidence in detecting 0.5% non-WSCT genetic admixture) genetic sampling point or a microsatellite point are labelled with low genetic certainty (dashed line), with the category matching the genetic sampling point.

- Rule applies to the stream and tributaries upstream of the genetic sampling point to the next upstream extent, whether that is another genetic sampling point, permanent barrier, or headwater streams.
- Rule applies to the stream and tributaries downstream of the genetic sampling point to a permanent barrier on the same stream segment, only if no other SNP genetic sampling point exists between the point and the barrier.

Bow River watershed examples:

- Margaret Creek in the Waiparous Creek watershed (HUC 0402070104) upstream from the SNP tested genetic site MAG-3 (74.4% confidence to detect 0.5% genetic admixture) to headwater streams, code all streams and tributaries to the low confidence pure category.
- Loomis Creek and Bishop Creek in the Upper Highwood River watershed (HUC 0402120101) upstream from the permanent barrier B_B052 on Loomis Creek to the headwater streams on both creeks, code streams and tributaries to the low confidence near pure category based on the microsatellite point J-H33 (near pure).

Oldman River watershed examples:

- Hidden Creek in the Hidden Creek watershed (HUC 0401010102) upstream from the SNP tested genetic site Hidden4 (90.8% confidence to detect 0.5% genetic admixture) to the headwater streams, all streams and tributaries are coded to the low confidence pure category. SNP data overrides the upstream microsatellite point AFW-HC.
- Snowshoe Creek in the Carbondale River watershed (HUC 0401010304) upstream from the pure microsatellite point ACA-121 to the headwater streams, code all streams and tributaries to the low confidence pure category.

RULE 4: SEGMENTS OF STREAM BELOW THE FURTHEST DOWNSTREAM GENETIC SAMPLING SITES AND BARRIERS, DOWNSTREAM TO THE POINT WHERE WSCT AND/OR RNTR NO LONGER OCCUR (BARRIERS MAY OR MAY NOT BE PRESENT)

As part of the Genetic Delineation Project to create a spatial dataset of WSCT distribution and genetic status covering the species' entire historic native range in Alberta, genetic status is only assigned as far downstream as the responsible biologists believe WSCT and/or RNTR populations still occur. Beyond this point, the lower most portions of the watershed are left uncategorized (dashed light blue), because re-establishing a functional WSCT population in the short-term is not considered feasible in these areas.

Downstream of the furthest downstream genetic sampling site, segments of a mainstem stream and associated tributaries (as far upstream as 1st order tributaries or up to the point where a barrier or another genetic sampling site changes the category) are always labelled with the low confidence hybridized (dashed orange) genetic category to the downstream limit beyond which the responsible biologists believe WSCT and/or RNTR populations do not occur.

Bow watershed example:

- Genetic sampling sites on tributaries to the Elbow River including creeks such as Canyon Creek (J-E 15), Silvester Creek (AFW-SiC), and Ranger Creek (J-E 10) in the Middle and Lower Elbow River (HUCs 0402100102, 0402100103) are the furthest downstream sampling sites. All stream segments downstream of these sites, including the mainstem rivers downstream to the Middle Bow River (Dalemead Lake HUC 0402090101), as well as unsampled tributaries with no genetics, are labelled 'low confidence hybridized' (dashed orange).

Oldman watershed example:

- Oldman River below the Oldman Reservoir (HUC 0401010501) downstream from the sampling site OldR3 to the Lethbridge Northern Irrigation District weir (B_O007) is labelled low confidence hybridized (dashed orange). Tributaries to this reach, including Pincher Creek, are labelled low confidence hybridized (dashed orange) WSCT and/or RNTR populations are not believed to occur downstream of the weir.

RULE 5: STREAM SEGMENTS UPSTREAM OF A BARRIER WITH NO WESTSLOPE CUTTHROAT TROUT RECORDS OR GENETIC INFORMATION ABOVE THE BARRIER

Stream segments upstream of barriers where no genetic data have been collected will be categorized as:

- "All Fish Species Status Unknown", if no fish have been captured or previously documented (dashed purple), or
- "WSCT Status Unknown" if WSCT have not been previously documented or observed, but other fish species are present (dashed dark blue).

Oldman watershed examples:

- A headwater reach of North Drywood Creek between two barriers (B_O109 and B_O067) in the Drywood Creek watershed (HUC_0401030203) where no WSCT have been sampled, but Brook Trout (BKTR) do occur, is classified as "WSCT Status Unknown".
- Grizzly Creek in the Upper Castle (HUC 0401010301) above the barrier (B_O076), where BKTR and RNTR occur due to stocking, but WSCT have not been sampled is classified as "WSCT Status Unknown".

Bow watershed examples:

- Volcano Creek, in the Threepoint Creek watershed (HUC 0402120203), above the waterfall barrier (B_B065) is classified as "All Fish Species Status Unknown", where no fish have been documented, although there has been limited sampling.
- Cat Creek, above waterfall (B_B022) located near the mouth of the Highwood River in the Upper Highwood River watershed (HUC 0402120101), may still have remnant RNTR and BKTR from historical stocking, so it is classified as "WSCT Status Unknown", because other species may be present here, but WSCT have not been confirmed.

RULE 6: STREAM SEGMENTS UPSTREAM OF A BARRIER WHERE CUTTHROAT TROUT HAVE BEEN CAPTURED OR OBSERVED BUT NO GENETIC INFORMATION IS AVAILABLE

Segments of the stream network upstream of a barrier where Westslope Cutthroat Trout have been previously captured or observed (FWMIS, historical or anecdotal records), but genetic purity is unknown, are categorized as 'low confidence pure'. Taking a precautionary approach, even if RNTR have also been captured or observed upstream of the barrier, the 'probable pure' classification is still applied until genetic results either confirm or negate this assumption.

Oldman watershed example:

- York Creek upstream of barrier B_O145 in the Crowsnest watershed (HUC 0401010201)

Bow watershed examples:

- Baril Creek upstream of barriers B_B109 and B_B110 in the upper Highwood Watershed (HUC 0402120101)
- Elbow River upstream of barrier B_B088 in the upper Elbow Watershed (HUC 0402100101)

DATA RELIABILITY - MONITORING QUALITY, QUANTITY AND TIMELINESS METRICS:

For each stream segment or series of stream segments where a genetic status has been assigned, a rationale and evaluation of data certainty will be provided. The rationale will refer to the specific rule followed and/or the background data supporting the genetic assignment. Data quality, quantity and timeliness will be evaluated and ranked as per the guidelines provided below and is adapted from Section 2.5 of "A Generic Rule Set for Applying the Alberta Fish Sustainability Index", Second Edition (Alberta Government 2014).

KEY ASSUMPTIONS AND RISKS:

- This dataset is considered 'live' and will be updated with new information as required. Data as presented is subject to change based on advancing technology and continual collection of genetic material.
- Data are stored on the Blairmore U:/drive and access permission is required. Data are stored in file geodatabase and is a single-user database (only one user can edit a feature class at a time). This is the MASTER COPY: \\env.gov.ab.ca\gis\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping
- A Westslope Cutthroat Trout Tool and User Guide has been developed by Don Page of RIU– the WSCT Mapping Tool is an add-in for ArcMap that allows users to apply stream tracing, genetic attribution, split hydrology at sites and quality control checks to the spatial data set.
- Species presence is verified through AEP's FWMIS data, current and historical species or location-specific data, stocking records or other available data.
- Barrier information included in the dataset represents barriers identified directly by Fisheries Management (historic and recent data) or consultants working directly for Fisheries Management (Interior Reforestation Co Ltd, Lotic Environmental, Alberta Conservation Association) while conducting WSCT inventory work. As such, the barrier dataset may not be comprehensive and inclusive of all barriers present on the landscape.
- The quality, quantity and timeliness of data are assessed as per the metrics presented above. A record of the data reliability ranking and associated rationale is maintained for each genetic status assessment.
- In general, the most precise genetic data will supersede older, inexact genetic data, as per the guidance specified in Table 3. Data age, sample size, type of genetic analysis technique used, and confidence in the power of admixture detection are important considerations in determining which data to use to delineate genetic status.
- A known sampling site or barrier is required between stream segments of different genetic categories.
- 'All Fish Species Status Unknown' category – This category represents a data deficiency in which no fish species are known to have been captured, observed or stocked. This category could imply habitat limitations to support fish or a lack of sufficient sampling effort.
- The two data deficient categories ("All Fish Species Status Unknown" and "WSCT Status Unknown") will still be associated with a management outcome. Include the two categories internally; however, a combined category such as "potential recovery habitat" or "potential expansion of range" may be used for an external version of the GDP map with broader distribution.
- Confidence in the results of genetic analysis is higher for the solid lines and less certain for the dashed lines.
- Professional discretion may be used to adjust rules based on scale and other available information e.g., species composition. Where professional discretion is used to adjust a rule, the rationale must be documented in the accompanying spreadsheet.
- The coding applies to all mapped and unmapped tributaries. Deals with issues of scale if someone is looking at a more detailed hydro layer for example.

- The hydro layer is sourced from Alberta's Fish & Wildlife Management Information System (FWMIS) and may not reflect recent changes to the stream layer (e.g. post-flood flow alterations).
- From the FSI rule set: "A zero represents a functionally extirpated population (e.g. no fish were detected in recent history, or extirpation is suspected). While a few individuals may still occur in a functionally extirpated population, it is not thought to constitute a viable population".
- Historic range has been based on Dave Mayhood's map in the recovery plan (his information sources are documented in the RP).
- The precautionary management principle was considered and applied in the formation of the genetic ruleset and resultant spatial product, as per the guidance in AEP's Fish Conservation and Management Strategy for Alberta (2014).
- This product will be used to outline current day presence and genetic purity of populations that in turn will be utilized to help feed data into the Fish Sustainability Index (FSI) process. The FSI will be linked to the Fish Conservation Strategy and help in setting Fisheries Management Objectives.

Stocked Populations

- There are some pure or probable pure stocked populations which fall within historic range; some are believed to be in areas which were historically fishless (e.g., headwater lakes).
- The reason for the distinction is that these populations may be managed for recreational purposes so the FMO may be different.
- As well, in context of the recovery plan, stocked pure strains in formerly fishless areas may not count towards a recovered population within historic range or be considered as part of the COSEWIC listing.
- However, where there is reasonable uncertainty as to the origin of the fish, be precautious - Pick a category and give the level of confidence (e.g., high confidence pure or low confidence pure etc.).
- Populations thought to have been native pure but that have been stocked upon with WSCT at some point in past, will be treated as "pure" and not "stocked pure".

Additional Reference Documents:

Allen, B., M. Anderson, J.A. Mee, M. Coombs, and S.M. Rogers. 2016. The role of genetic background in the introgressive hybridization of Rainbow Trout (*Oncorhynchus mykiss*) with Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) in Alberta, Canada, Conservation Genetics.

Allendorf, F. W., R. F. Leary, N. P. Hitt, K. L. Knudsen, L.L. Lundquist, P. Spruell. 2004. Intercrosses and the US Endangered Species Act: should hybridized populations be included as westslope cutthroat trout? Conservation Biology 18(5): 1203-1213.

Elliott, J. M. 1986. Spatial distribution and behavioural movements of migratory trout *Salmo trutta* in a Lake District stream. The Journal of Animal Ecology 907-922.

Elliott, J. 1990. Mechanisms Responsible for Population Regulation in Young Migratory Trout, *Salmo trutta*. III. The Role of Territorial Behaviour. Journal of Animal Ecology 59(3): 803-818.

Fausch, K. D., B. E. Rieman, J. B. Dunham, M. K. Young and D. P. Peterson. 2009. Invasion versus Isolation: Trade-Offs in Managing Native Salmonids with Barriers to Upstream Movement. Conservation Biology 23(4): 859-70.

Gowan, C., and K. D. Fausch. 2002. Why do foraging stream salmonids move during summer? Environmental Biology of Fishes 64:139–153.

Kirk, H., and J. R. Freeland. 2011. Applications and implications of neutral versus non-neutral markers in molecular ecology. International Journal of Molecular Sciences 12(6): 3966-3988.

Kovach, R., C. Muhlfeld, M. Boyer, W. Lowe, F. Allendorf, and G. Luikart. 2014. Dispersal and selection mediate hybridization between a native and invasive species. Proc. R. Soc. B, 282, 9-9.

Mayhood, D. W. and E. B. Taylor. 2011. Contributions to a recovery plan for Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) in Alberta: distribution, population size and trends. Report prepared for Fish & Wildlife Division, Alberta Sustainable Resource Development, by Freshwater Research Limited, FWR Technical Report No. 2011/06-1, Calgary, AB. vi+47pp. + Appendix.

Paul, A. J. and J. R. Post. 2001. Spatial distribution of native and non-native salmonids in streams of the eastern slopes of the Canadian Rocky Mountains. Transactions of the American Fisheries Society 130:3.

Pritchard, V. L., K. Jones, and D. E. Cowley. 2007. Estimation of introgression in cutthroat trout populations using microsatellites. Conservation Genetics 8(6): 1311-1329.

Rasmussen, J.B., M.D. Robinson and D.D. Heath. 2010. Ecological consequences of hybridization between native Westslope Cutthroat (*Oncorhynchus clarkii lewisi*) and introduced Rainbow (*Oncorhynchus mykiss*) Trout: effects on life history and habitat use. Canadian Journal of Fisheries and Aquatic Sciences 67(2): 357–370.

Rodríguez, M.A. 2010. A modeling framework for assessing long-distance dispersal and loss of connectivity in stream fish. pp. 263-279 in: Community Ecology of Stream Fishes, Gido, K., and D. Jackson (eds.), American Fisheries Society, Bethesda, Maryland.

The Alberta Westslope Cutthroat Trout Recovery Team. 2013. Alberta Westslope Cutthroat Trout Recovery Plan: 2012-2017. Alberta Environment and Sustainable Resource Development, Alberta Species at Risk Recovery Plan No. 28 Edmonton, AB: 77pp.

Utah Division of Wildlife Resources. 2000. Cutthroat trout management: a position paper. Genetic considerations associated with cutthroat trout management. Utah Division of Wildlife Resources, Publication 00-26, Salt Lake City. 12pp.

Yau, M. M. and E.B. Taylor. 2013. Environmental and Anthropogenic Correlates of Hybridization between Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) and Introduced Rainbow Trout (*Oncorhynchus. mykiss*). Conservation Genetics 14(4): 885-900.

Appendix: Ruleset Flowchart

Helpful Tips

- Stream segment = continuous stream length, not including tributaries (important when determining which microsatellite data points are overridden by SNP data)
- A genetic point is only used to code stream segments upstream of that point; EXCEPTION – coding between a permanent barrier downstream of a genetic point on the same stream segment
- The genetic category of the hydro layer may only change at a permanent barrier or a genetic sample site

Identify stream segment you wish to code:

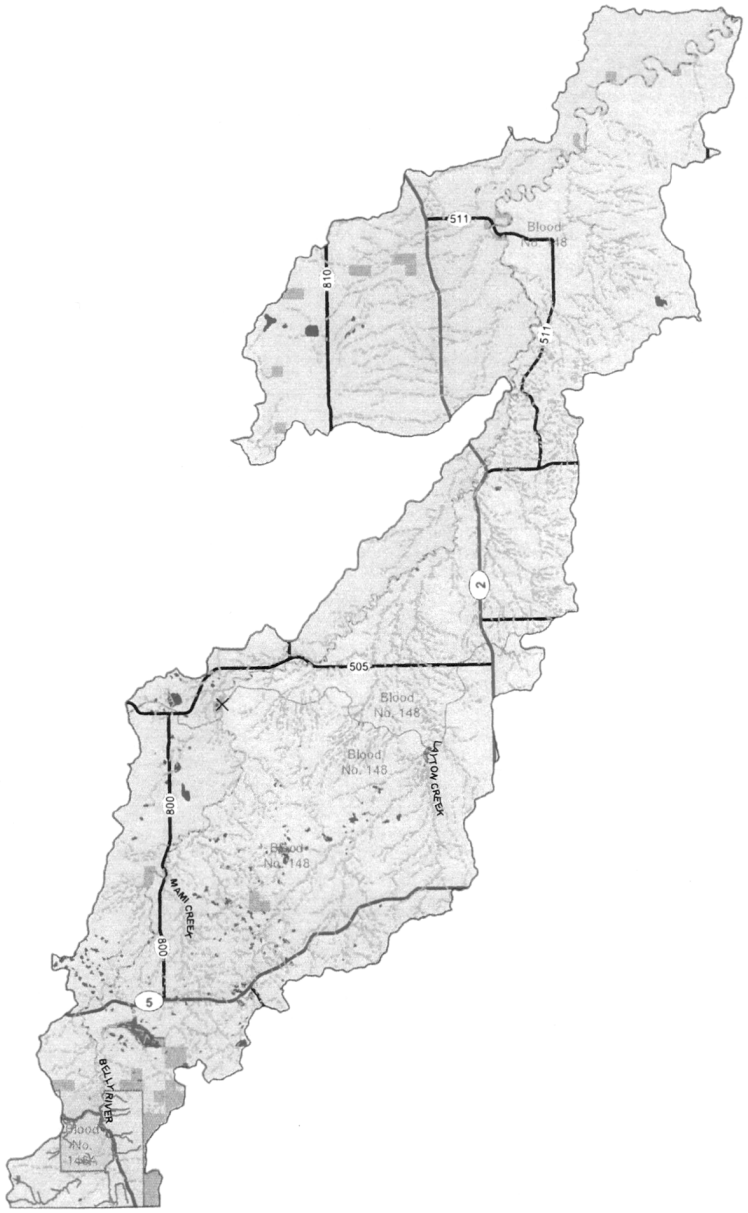
1. Determine if stream segment occurs downstream of any genetic sampling points
    a. No, segment is upstream of all genetic sampling points > go to step 2
    b. Yes, segment occurs downstream of a genetic sampling point > go to step 5
2. Identify the number of genetic sites on the stream segment
    a. Zero > go to step 3
    b. One or more > go to step 5
3. Identify the next downstream break
    a. Barrier > go to step 4
    b. Genetic point > go to step 5
4. Use FWMIS records and local knowledge to identify species composition in the stream segment
    a. No records known or available > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'ALL FISH SPECIES STATUS UNKNOWN'**
    b. No confirmed records of WSCT, but other fish species have been captured or observed > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'WSCT STATUS UNKNOWN'**
5. Identify the number of genetic sites on the stream segment
    a. One > go to step 6
    b. More than one > go to step 7
6. Select all stream segments upstream of the identified genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or permanent barrier and/or next upstream genetic point)
    a. If confidence in genetic sampling point is high > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8
    b. If confidence in genetic sampling point is low > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > go to step 8
    c. After coding stream based on A or B, go to step 11
7. Identify all genetic points on the stream segment and their relevance (see Rule 1)
    a. More than one high confidence genetic point > Separately for each point, select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8
    b. More than one low confidence genetic point > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the

most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > go to step 8

****Reminder – override microsatellite points that occur upstream of SNP data points on the same stream segment. Microsatellite data points occurring on separate stream segments remain valid and can be used for coding.**

c. Both high and low confidence genetic points > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8

8. Identify any permanent barrier(s) on the stream segment, downstream of the genetic point used in coding, but upstream of any addition genetic points
   a. No permanent barrier(s) exist > no changes required
   b. One permanent barrier exists > select all stream segments upstream of the permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP**
   c. More than one permanent barrier exists > select all stream segments upstream of the most upstream permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP** > select all stream segments downstream of the most upstream permanent barrier to the next downstream permanent barrier > **CODE STREAM AND TRIBUTARIES TO **SAME GENETIC CATEGORY USED IN PREVIOUS STEP* - LOW CONFIDENCE DASHED LINE**



Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout
BELLY RIVER

HUC 8: 04010301

Map Date: January 10, 2019

0 3 6 12 18 24 30 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership
- Federal
- Municipal
- Private
- Provincial

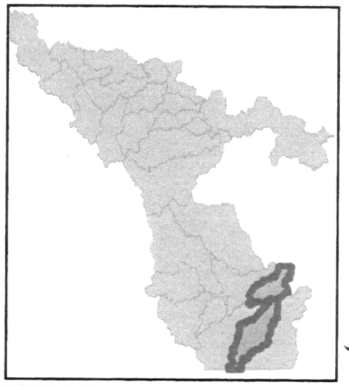
Genetic Purity
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

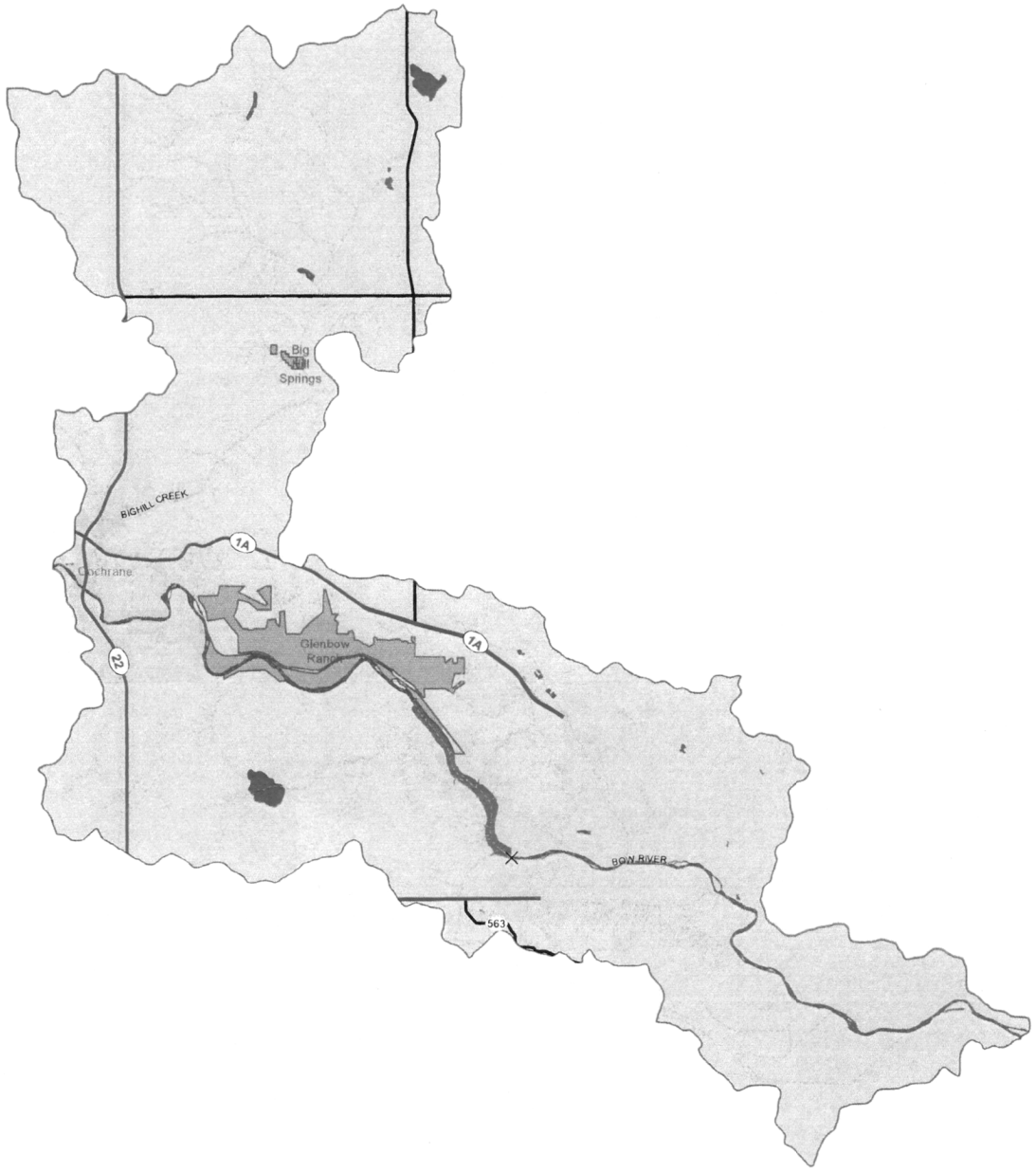


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

BOW RIVER AND BIGHILL CREEK

Map Date: January 10, 2019 HUC 8: 04020801

0 1.25 2.5 5 7.5 10 12.5 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership
- Federal
- Municipal
- Private
- Provincial

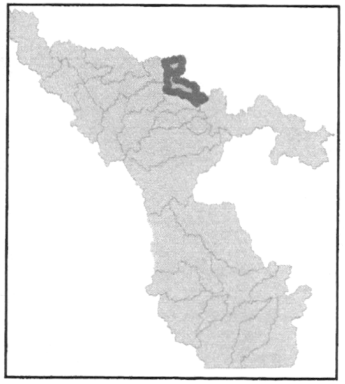
Genetic Purity
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

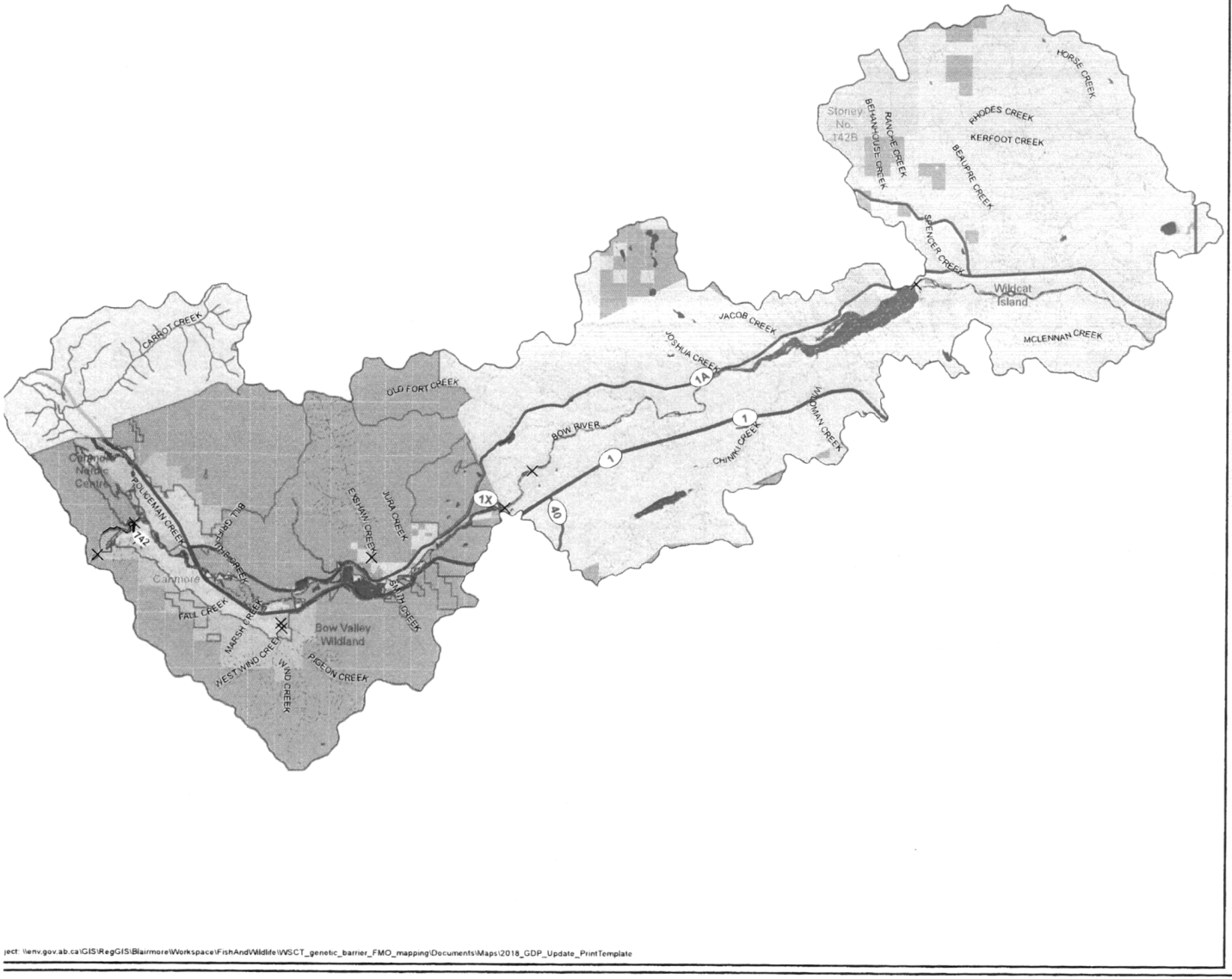


N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate



Alberta Environment and Parks, South Saskatchewan Region

Westslope Cutthroat Trout

BOW RIVER AND GHOST RESERVOIR

Map Date: January 10, 2019 HUC 8: 04020401

0 2 4 8 12 16 20 Kilometers

Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

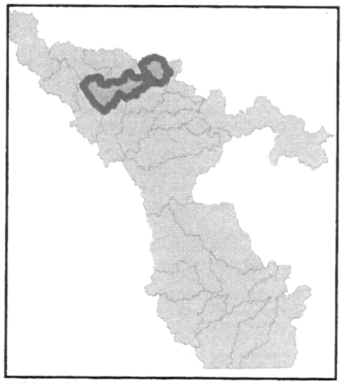
- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented
- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways — Secondary Highways

Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP. Blairmore. South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

Data Frame: NAD 1983
10TM AEP Forest

Alberta Government

ject: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

WESTSLOPE CUTTHROAT TROUT GENETIC DELINEATION PROJECT- MAPPING RULE SET

OBJECTIVE: To create a spatial dataset of Westslope Cutthroat Trout (WSCT) distribution and genetic status covering the species' entire historic native range in Alberta. This dataset categorizes all mapped watercourses, Strahler first order and above, based on known genetic status of WSCT, where possible, and WSCT presence/absence where no genetic results are currently available. Genetic status reflects the level of genetic purity of native WSCT, as measured with respect to hybridization with the non-native trout. Fish tissue samples (fin clips) are analysed to estimate the proportion of each individual fish genome being WSCT, as opposed to other non-native trout. The average of these admixture proportions (Q_{WSCT}) forms the basis of the genetic categories that are assigned, as outlined below.

The WSCT Genetic Delineation Project (GDP) will consist of geographic information system (GIS) layers spatially representing genetic status (or presence/absence, where genetic data are lacking), and associated measures of data uncertainty. WSCT Fisheries and Habitat Management Objectives based on genetic status, as well as other factors including status and abundance, population integrity and natural and anthropogenic limitations and threats to habitat, are not included in the product, but will be linked to these GIS layers in the future. A generalized version of these data will be summarized and presented as a spatial map product available to internal and external stakeholders to communicate WSCT genetic status.

This dataset will also be used to:

- identify existing data deficiencies and assist regional Fisheries Staff in work load prioritization
- inform the development of appropriate, rational, adaptive fisheries and habitat management objectives
- inform and/or support land use decisions
- guide, inform, and support federal and provincial species recovery
- inform and support the WSCT Fish Sustainability Index

DATA UNCERTAINTY:

Genetic status and WSCT presence/absence cannot be mapped with absolute certainty. Two reasons for this are:

1. For a given site on a stream where a genetic sample is collected, only a subsample of all the fish in that reach is sampled. From this subsample, genetic status in that sample reach (called a sample site) is estimated with some uncertainty. For example, fin clips may be collected from 30 individuals in a 300 m reach of stream. The actual number of fish in that reach is likely much larger than the 30 fish sampled, but just 30 fish are used to estimate genetic status at that site.
2. At the scale of the entire stream network, genetic status from a small number of sample sites is used to infer genetic status over much longer segments of stream upstream and downstream of the sampled site(s). Genetic samples are not collected from these longer segments; genetic status is just inferred. Reaches of stream where genetic samples are collected (sample sites) represent a small subsample of all possible reaches where samples could have been collected and where genetic status is unknown. For example, the genetic status of a 300 m reach of stream may be used to infer the genetic status of 30 km of stream upstream from that reach where no genetic analysis has been performed.

Confidence in genetic admixture detection within a population will vary with sample size, type of analysis method used and age of data. We calculated confidence to detect admixture by using a Binomial power analysis approach:

% confidence = 1-(1-x)^a*b where x = % non-WSCT admixture to be detected
a = number of diagnostic loci used in the analysis
b = number of fish sampled

Due to the nature of hybridization between WSCT and non-WSCT species, biologists have determined that the ability to detect 0.5% hybridization within a population is the benchmark for current SNP analysis; we are currently using 34 diagnostic loci. Stream segments associated with a genetic sampling site in which there is a low confidence (<99.6%) that the sample size has the power to detect 0.5% non-WSCT admixture will be categorized as 'low' confidence (dashed lines). Example:

- If we sample one (1) fish using 34 diagnostic loci (utilizing SNP's) then we are 28.9% confident that we can identify .5% admixture in that individual = **low confidence**.
- If we sample 16 fish using 34 diagnostic loci (utilizing SNP's) we are 99.6% confident that we can identify .5% admixture in those individuals = **high confidence**.

Confidence to detect calculations are not possible for earlier data obtained through microsatellite analysis, as this analysis used non-diagnostic loci. Previously conducted microsatellite analysis will still be used to identify the genetic category stream segments, but these will be categorized as having 'low' confidence (dashed lines) as they utilized non-diagnostic markers.

Information from diagnostic loci are used to address issues concerning the relative amount of divergence among WSCT populations, how genetically different separate populations are from one another. Diagnostic loci are also used for estimating levels of genetic variation, sibling relationships, assignment of fry to parents, as well as estimates of the effective number of breeding adults that produced a year class (review by Kirk & Freeland 2011). When processing genetic results we are looking for polymorphisms. Polymorphisms can mimic hybridization, but diagnostic loci allow us to differentiate natural polymorphisms from hybridization events over time (Allendorf et al. 2004). Using diagnostic loci for genetic analysis is the preferred technique for quantifying hybridization in all subspecies of Cutthroat Trout (Utah Division of Wildlife Resources 2000). Non-diagnostic loci are less informative as they cannot easily differentiate between ancestral polymorphisms and hybridization (Pritchard et al. 2007).

The downstream extent of Cutthroat Trout within the Bow River and Oldman River watersheds was determined using the best available data on the species presence and absence. This information was used to make assessments in areas where genetic information is limited or unknown, and is always labelled with low confidence.

Levels of confidence for genetic status of stream segments are categorized and mapped spatially as 'high' and 'low' as well as recorded in detail in an associated database. The following is a summary of the types of stream segments broadly categorized as having high and low confidence:

High confidence segments (mapped as solid stream lines) include the following:

- Any stream segments that are coded using single nucleotide polymorphism (SNP) tested data in which the confidence in detecting 0.5% genetic admixture is ≥99.6% (i.e. sample sites with ≥16 fish). This includes stream segments:
  - Upstream from a high confidence SNP point to the next upstream extent (all stream orders including Strahler 1st order streams and/or permanent barrier and/or next genetic site)

- Downstream from a high confidence SNP point to a permanent barrier on the same stream segment, providing no other SNP genetic points exist in between

Low confidence segments (mapped as dashed stream lines) include the following:

- Any stream segments that are coded using single nucleotide polymorphism (SNP) tested data in which the confidence in detecting 0.5% genetic admixture is <99.6% (i.e. sample sites with <16 fish), or any stream segments that are coded using microsatellite data. This includes stream segments:
  - Upstream from a low confidence SNP or microsatellite point to the next upstream extent (all stream orders including Strahler 1st order streams and/or permanent barrier and/or next genetic site)
  - Downstream from a low confidence SNP or microsatellite point to a permanent barrier on the same stream segment, providing no other SNP genetic points exist in between
- Segments where WSCT are present, no genetic information exists, but they are suspected pure (generally above physical barriers, although the responsible biologists may believe other types of barriers to upstream hybridization pressure are at play).
- Segments where WSCT or all fish species presence is unknown (see below). Absence of fish is never certain, because it is impossible to adequately sample all habitat, and because fish may occupy the stream segment at times when the stream is not sampled.

Assumptions:

Given that upstream and downstream dispersal of WSCT, non-native trout, and their hybrids occurs continuously, there are two basic assumptions of the WSCT GDP:

1. Hybridization with WSCT is generally moving in an upstream direction from lower reaches in watersheds where stocking initially occurred and water temperatures are more suited for non-native black-spotted trout, such as Rainbow Trout (RNTR), to upper reaches where colder temperatures, as well as other factors like stream gradient and timing of the spring freshet, are excluding or impeding RNTR invasion. This upstream direction of hybridization has been well documented in Alberta (Paul and Post 2001, Rasmussen et al. 2010, Yau and Taylor 2013) as well as other jurisdictions (Fausch et al. 2009, Kovach et al. 2014).
2. WSCT genetic purity at a sample site on a stream reflects the cumulative genetic status of all WSCT upstream of that site. Downstream movement of fish is continually occurring from the entire stream network upstream of that site. Dispersal studies of salmonid movement indicate downstream movement is always occurring, resulting from competition (Elliott 1986, 1990), habitat selection (Gowan and Fausch 2002), or random dispersal (Rodríguez 2010).

Therefore, the genetic results from a specific sampling site reflect both:

- The current amount of hybridization in terms of admixture proportion (Q_{WSCT}) that has reached that point coming from upstream hybridization pressure from fish further downstream
- A cumulative assessment of the overall WSCT genetic status (admixture proportion, Q_{WSCT}) upstream of that site

Due to these two fundamental assumptions, two broad rules apply:

1. The entire stream network upstream of a genetic sample site is categorized based on the category and confidence of that point. This coding is carried upstream until the next upstream extent is encountered, whether that be another genetic point, a migration barrier, or the headwater streams of that system.
2. Category coding from a genetic sample site is only carried downstream on the stream network when a migration barrier exists downstream of the site which limits the upstream movement of fish into the stream segment

In other words, genetic category coding is always carried upstream from a site, unless a permanent migration barrier exists downstream, in which case the genetic category coding is also carried downstream from the point. A detailed rule set is outlined below.

Stream map categories:

WSCT genetic sampling sites (discrete reaches of stream, usually 300m in length, but represented by a single point at the downstream start location) are assigned to the genetic categories in the table below based on genetic data from fin clips collected at each site. There is uncertainty associated with WSCT genetic purity at these sites, because only a subsample of all the fish in the sample site is genetically tested. It is assumed that genetic status is known based on the best available data at these sites, and stream segments throughout WSCT native range are then assigned to these same genetic categories. However, at this stage when genetic purity is assigned to stream segments, data uncertainty is accounted for using solid (high confidence) and dashed (low confidence) stream lines. The number of fin clips successfully analysed at sampling sites and the genetic technique used for analysis are considered in the assignment of stream segments to high and low confidence within each genetic category. A detailed assessment of the uncertainty associated with the genetic status assigned is also recorded qualitatively in the same database used to categorise the stream segments.

To date, genetic data from Dr. Rick Taylor's lab at the University of British Columbia (2006-2011), Dr. Sean Roger's lab at the University of Calgary (2013-2015) and Dr. Steven Amish's lab at the University of Montana (2016 to present) have been used to inform WSCT mapping.

The tables below outline the categories used to:

1. Map genetic sampling sites (points) – Table 1
2. Map stream network categories (color coded stream segments) – Table 2

Table 1. Mapped WSCT genetic sampling site categories

Category Name	Symbology	Description and definition
Genetically pure		Pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is ≥ 0.985.
Genetically near-pure		Near-pure genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.985 but ≥ 0.945.
Genetically hybridized		Hybridized genetic sampling site where the average of individual Q_{WSCT} values (admixture proportions) of fish sampled is < 0.945.
Samples Not Tested		Fin-clip samples collected from black-spotted trout at sampling site have not been genetically tested.
No Samples Taken		Black-spotted trout were captured or observed at the site, but no fin-clip samples were taken.

No CTTR	⊖	No black-spotted trout captured at sampling site but other fish species were present.
No fish caught	⊜	No fish captured at sampling site.
Dry	⊕	Survey attempted, but not completed because the stream was dry at that time

*The method of genetic analysis at a sampling site is symbolized with a 'circle' for single nucleotide polymorphisms (SNPs) and a 'square' for microsatellites.

Table 2. Mapped WSCT stream network categories

Category Name	**Colour Code**	**Description and definition**
Genetically pure (high confidence)	Solid green	Length of stream that is either upstream of a high confidence pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be ≥ 0.985.
Genetically near-pure (high confidence)	Solid yellow	Length of stream that is either upstream of a high confidence near-pure genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is assumed to be <0.985 but ≥0.945.
Genetically hybridized (high confidence)	Solid orange	Length of stream that is either upstream of a high confidence hybridized genetic sampling site or between this point and a downstream barrier. Based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish sampled in this contiguously labeled length of stream is < 0.945. Unlike the pure and near-pure categories above where the assumed genetic purity lies within a narrowly defined range of Q_{WSCT} values, genetic purity can vary broadly in the genetically hybridized category from relatively high (near 95%) to very low (0%).
Genetically pure (low confidence)	Dashed green	Length of stream that is either upstream of a low confidence pure genetic sampling site or between this point and a downstream barrier. This also includes stream lengths with no genetic analysis, but WSCT are known to be present, and a barrier at the downstream end is preventing hybridization. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, the average Q_{WSCT} value (admixture proportion) of fish in this contiguously labeled segment of stream network is still assumed to be ≥0.985.
Genetically near-pure (low confidence)	Dashed yellow	Length of stream that is either upstream of a low confidence near-pure genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions) of fish in this contiguously labeled segment of stream network is still assumed to be <0.985 but ≥0.945.
Genetically hybridized (low confidence)	Dashed orange	Length of stream that is either upstream of a low confidence hybridized genetic sample site or between this point and a downstream barrier. Dashed labelling is used, because of higher uncertainty of genetic status, but based on assumptions and rules in this ruleset, average individual Q_{WSCT} values (admixture proportions)

Category Name	Colour Code	Description and definition
		of fish in this contiguously labeled segment of stream network is still assumed to be < 0.945.
WSCT Status Unknown	Dashed dark blue	Length of stream with no confirmed records of WSCT, but other fish species have been captured or observed in this contiguously labeled segment of stream
All Fish Species Status Unknown	Dashed purple	Length of stream above a barrier with no confirmed records of any fish species present in this contiguously labeled segment of stream.
Uncategorized	Light blue	Length of stream where either: – WSCT never occurred as part of a functional population within the species' historic range; or, – WSCT are no longer present or may only occur as rare vagrants, and re-establishing a functional population in the short-term is not feasible

RULE SET FOR ASSIGNING GENETIC STATUS TO STREAM SEGMENTS

RULE 1: SNP DATA OVERRIDES MICROSATELLITE DATA ON THE SAME STREAM SEGMENT

Analysis of hybridization in Westslope Cutthroat Trout populations in Alberta began in the early 1980s and broad-scale range-wide monitoring began over a decade ago. The technology to measure hybridization and genetic diversity is rapidly advancing and Alberta has recently transitioned to using more advanced methods consistent with those used in neighbouring jurisdictions (i.e., from microsatellites to single nucleotide polymorphisms, SNPs). In addition, the number of non-native trout species that Alberta's WSCT are being assessed for hybridization with has been expanded beyond just Rainbow Trout (*O. mykiss*), to include Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*), Golden Trout (*O. mykiss aguabonita*), and Coastal Cutthroat Trout (*O. clarkii clarkii*). As such, the genetic data available at a given sampling location can vary with respect to the age of data, analysis method used and species assessed for hybridization. Prior to 2016, all genetic analysis was conducted using non-diagnostic microsatellite markers. Since 2016, single nucleotide polymorphism (SNP) analysis using diagnostic loci has been used to assess hybridization in Alberta's WSCT populations. The varying accuracy and confidence in the detection of non-WSCT genetics between microsatellite and SNP analysis has culminated in a hierarchy of genetic results (Table 3).

In instances where repeated genetic samples have been collected along a stream segment, the most recent sample analyzed with the most advanced genetic technique (currently, single nucleotide polymorphisms) will be used to assign the genetic category to this reach of stream. To ensure consistent and repeatable application of this rule, the following guidance with respect to data quality (genetic technique, sample sizes, power to detect, and level of admixture) will be applied to determine which genetic data should be used when applying the remaining ruleset to delineate genetic status (Table 3).

Table 3. Rank of the confidence of genetic results based on the type of analysis and sample size.

Confidence Ranking	Analysis Type	Sample Size	Coding Procedure
High (≥99.6% confidence in detecting 0.5% non-WSCT admixture)	SNP (diagnostic markers)	≥16 fish	All points considered – code associated arc(s) as high confidence (solid line)
Low (>0 - <99.6% confidence in detecting 0.5% non-WSCT admixture)	SNP (diagnostic markers)	<16 fish	All points considered – code associated arc(s) as low confidence (dashed line)
Minimum (confidence in detecting 0.5% non-WSCT admixture could not be calculated with non-diagnostic markers)	Microsatellite (non-diagnostic markers)	>0	Consider points if they are the only available data for the stream segment. If SNP data exists downstream on the same segment, defer to SNP results and disregard microsatellite point. Code associated arc(s) as low confidence (dashed line). *Note: If samples were initially tested with microsatellite analysis, then retested with SNP analysis, defer to SNP results.

- Rule applies to all areas and situations. Before coding stream using any of the following rules, it must first be determined if any microsatellite data is overridden by SNP data. Microsatellite data is overridden by SNP data and must be disregarded in any of the following circumstances:
    - Microsatellite genetic point occurs upstream from a SNP genetic point (high or low confidence), on the same stream segment (i.e. continuous stream length, not including tributaries)
    - A SNP point on a mainstem segment does not override microsatellite data on an associated tributary, when the microsatellite are the only data available on the tributary
    - Microsatellite genetic point occurs upstream from a permanent barrier, but downstream from a SNP genetic point (low or high confidence) on the same stream segment (i.e. continuous stream length, not including tributaries)

Bow River watershed examples:

- Zephyr Creek in the Middle Highwood River watershed (HUC 0402120103) between permanent barriers B_B028 and B_B111, the pure SNP tested genetic site ZEP-01 (100% confidence to detect 0.5% genetic admixture) overrides the two microsatellite points J-H18 (pure) and J-H18d (near pure). All streams and tributaries are coded to the high confidence pure category.
- Quirk Creek in the Upper Elbow River watershed (HUC 0402100101) upstream from the near pure SNP tested genetic site upper reach (49.4% confidence to detect 0.5% genetic admixture) to the headwater streams, where the SNP data overrides microsatellite point J-E20f (hybridized). All streams and tributaries are coded to the low confidence near pure category.

Oldman River watershed examples:

- Syncline Brook in the West Castle River watershed (HUC 0401010302) upstream from the near pure SNP tested genetic site Syncline1 (100% confidence to detect 0.5% genetic

admixture) to the barrier B_O110, where the SNP data overrides the microsatellite point ACA-37 (pure). All streams and tributaries are coded to the high confidence near pure category.

- Gold Creek in the Gold Creek watershed (HUC 0401010204) upstream from the pure SNP tested genetic site Gold4 (100% confidence to detect 0.5% genetic admixture) to the headwater streams, where the SNP data overrides the microsatellite point GC13BP (pure), but does not override the microsatellite point Cau15BP, which exists on Caudron Creek, a tributary to Gold Creek. All streams and tributaries, except Caudron Creek upstream from point Cau15BP, are coded to the high confidence pure category.

RULE 2: STREAM SEGMENTS ARE CODED TO HIGH CONFIDENCE, SOLID LINES WHEN THE SOURCE POINT IS A HIGH CONFIDENCE SNP GENETIC SAMPLING POINT

Stream segments that are coded using the data from a high confidence (≥99.6% confidence in detecting 0.5% non-WSCT genetic admixture) genetic sampling point are labelled with high genetic certainty (solid line), with the category matching the genetic sampling point.

- Rule applies to the stream and tributaries upstream of the genetic sampling point to the next upstream extent, whether that is another genetic sampling point, permanent barrier, or headwater streams.
- Rule applies to the stream and tributaries downstream of the genetic sampling point to a permanent barrier on the same stream segment, only if no other SNP genetic sampling point exists between the point and the barrier.

Bow River watershed examples:

- Ford Creek in the Upper Elbow River watershed (HUC 0402100101) upstream from the permanent barrier B_B084 to the headwater streams, code all streams and tributaries to the high confidence pure category based on the pure SNP tested genetic site FRD-3 (100% confidence to detect 0.5% genetic admixture).
- Silvester Creek (in the Middle Elbow River watershed (HUC 0402100103)) upstream from the permanent barrier B_B021 to barrier B_B005 and genetic point S9, code all streams and tributaries as high confidence pure category based on the two SNP tested genetic points. SNP's points S18 (pure, 100% confidence to detect 0.5% genetic admixture) and S15 (pure, 99.7% confidence to detect genetic admixture).

Oldman River watershed examples:

- Daisy Creek in the Racehorse Creek watershed (HUC 0401010106) upstream from the near pure SNP tested genetic site DS4 (99.9% confidence to detect 0.5% genetic admixture) all streams and tributaries are coded to the high confidence near pure category.
- Todd Creek in the Todd Creek watershed (HUC 0401010207) upstream from the hybridized SNP tested genetic site Todd1 (100% confidence to detect 0.5% genetic admixture) all streams and tributaries are coded to the high confidence hybridized category.

RULE 3: STREAM SEGMENTS ARE CODED TO LOW CONFIDENCE, DASHED LINES WHEN THE SOURCE POINT IS A LOW CONFIDENCE SNP OR MICROSATELLITE GENETIC SAMPLING POINT

Stream segments that are coded using the data from a low confidence (<99.6% confidence in detecting 0.5% non-WSCT genetic admixture) genetic sampling point or a microsatellite point are labelled with low genetic certainty (dashed line), with the category matching the genetic sampling point.

- Rule applies to the stream and tributaries upstream of the genetic sampling point to the next upstream extent, whether that is another genetic sampling point, permanent barrier, or headwater streams.
- Rule applies to the stream and tributaries downstream of the genetic sampling point to a permanent barrier on the same stream segment, only if no other SNP genetic sampling point exists between the point and the barrier.

Bow River watershed examples:

- Margaret Creek in the Waiparous Creek watershed (HUC 0402070104) upstream from the SNP tested genetic site MAG-3 (74.4% confidence to detect 0.5% genetic admixture) to headwater streams, code all streams and tributaries to the low confidence pure category.
- Loomis Creek and Bishop Creek in the Upper Highwood River watershed (HUC 0402120101) upstream from the permanent barrier B_B052 on Loomis Creek to the headwater streams on both creeks, code streams and tributaries to the low confidence near pure category based on the microsatellite point J-H33 (near pure).

Oldman River watershed examples:

- Hidden Creek in the Hidden Creek watershed (HUC 0401010102) upstream from the SNP tested genetic site Hidden4 (90.8% confidence to detect 0.5% genetic admixture) to the headwater streams, all streams and tributaries are coded to the low confidence pure category. SNP data overrides the upstream microsatellite point AFW-HC.
- Snowshoe Creek in the Carbondale River watershed (HUC 0401010304) upstream from the pure microsatellite point ACA-121 to the headwater streams, code all streams and tributaries to the low confidence pure category.

RULE 4: SEGMENTS OF STREAM BELOW THE FURTHEST DOWNSTREAM GENETIC SAMPLING SITES AND BARRIERS, DOWNSTREAM TO THE POINT WHERE WSCT AND/OR RNTR NO LONGER OCCUR (BARRIERS MAY OR MAY NOT BE PRESENT)

As part of the Genetic Delineation Project to create a spatial dataset of WSCT distribution and genetic status covering the species' entire historic native range in Alberta, genetic status is only assigned as far downstream as the responsible biologists believe WSCT and/or RNTR populations still occur. Beyond this point, the lower most portions of the watershed are left uncategorized (dashed light blue), because re-establishing a functional WSCT population in the short-term is not considered feasible in these areas.

Downstream of the furthest downstream genetic sampling site, segments of a mainstem stream and associated tributaries (as far upstream as 1st order tributaries or up to the point where a barrier or another genetic sampling site changes the category) are always labelled with the low confidence hybridized (dashed orange) genetic category to the downstream limit beyond which the responsible biologists believe WSCT and/or RNTR populations do not occur.

Bow watershed example:

- Genetic sampling sites on tributaries to the Elbow River including creeks such as Canyon Creek (J-E 15), Silvester Creek (AFW-SiC), and Ranger Creek (J-E 10) in the Middle and Lower Elbow River (HUCs 0402100102, 0402100103) are the furthest downstream sampling sites. All stream segments downstream of these sites, including the mainstem rivers downstream to the Middle Bow River (Dalemead Lake HUC 0402090101), as well as unsampled tributaries with no genetics, are labelled 'low confidence hybridized' (dashed orange).

Oldman watershed example:

- Oldman River below the Oldman Reservoir (HUC 0401010501) downstream from the sampling site OldR3 to the Lethbridge Northern Irrigation District weir (B_O007) is labelled low confidence hybridized (dashed orange). Tributaries to this reach, including Pincher Creek, are labelled low confidence hybridized (dashed orange) WSCT and/or RNTR populations are not believed to occur downstream of the weir.

RULE 5: STREAM SEGMENTS UPSTREAM OF A BARRIER WITH NO WESTSLOPE CUTTHROAT TROUT RECORDS OR GENETIC INFORMATION ABOVE THE BARRIER

Stream segments upstream of barriers where no genetic data have been collected will be categorized as:

- "All Fish Species Status Unknown", if no fish have been captured or previously documented (dashed purple), or
- "WSCT Status Unknown" if WSCT have not been previously documented or observed, but other fish species are present (dashed dark blue).

Oldman watershed examples:

- A headwater reach of North Drywood Creek between two barriers (B_O109 and B_O067) in the Drywood Creek watershed (HUC_0401030203) where no WSCT have been sampled, but Brook Trout (BKTR) do occur, is classified as "WSCT Status Unknown".
- Grizzly Creek in the Upper Castle (HUC 0401010301) above the barrier (B_O076), where BKTR and RNTR occur due to stocking, but WSCT have not been sampled is classified as "WSCT Status Unknown".

Bow watershed examples:

- Volcano Creek, in the Threepoint Creek watershed (HUC 0402120203), above the waterfall barrier (B_B065) is classified as "All Fish Species Status Unknown", where no fish have been documented, although there has been limited sampling.
- Cat Creek, above waterfall (B_B022) located near the mouth of the Highwood River in the Upper Highwood River watershed (HUC 0402120101), may still have remnant RNTR and BKTR from historical stocking, so it is classified as "WSCT Status Unknown", because other species may be present here, but WSCT have not been confirmed.

RULE 6: STREAM SEGMENTS UPSTREAM OF A BARRIER WHERE CUTTHROAT TROUT HAVE BEEN CAPTURED OR OBSERVED BUT NO GENETIC INFORMATION IS AVAILABLE

Segments of the stream network upstream of a barrier where Westslope Cutthroat Trout have been previously captured or observed (FWMIS, historical or anecdotal records), but genetic purity is unknown, are categorized as 'low confidence pure'. Taking a precautionary approach, even if RNTR have also been captured or observed upstream of the barrier, the 'probable pure' classification is still applied until genetic results either confirm or negate this assumption.

Oldman watershed example:

- York Creek upstream of barrier B_O145 in the Crowsnest watershed (HUC 0401010201)

Bow watershed examples:

- Baril Creek upstream of barriers B_B109 and B_B110 in the upper Highwood Watershed (HUC 0402120101)
- Elbow River upstream of barrier B_B088 in the upper Elbow Watershed (HUC 0402100101)

DATA RELIABILITY - MONITORING QUALITY, QUANTITY AND TIMELINESS METRICS:

For each stream segment or series of stream segments where a genetic status has been assigned, a rationale and evaluation of data certainty will be provided. The rationale will refer to the specific rule followed and/or the background data supporting the genetic assignment. Data quality, quantity and timeliness will be evaluated and ranked as per the guidelines provided below and is adapted from Section 2.5 of "A Generic Rule Set for Applying the Alberta Fish Sustainability Index", Second Edition (Alberta Government 2014).

KEY ASSUMPTIONS AND RISKS:

- This dataset is considered 'live' and will be updated with new information as required. Data as presented is subject to change based on advancing technology and continual collection of genetic material.
- Data are stored on the Blairmore U:/drive and access permission is required. Data are stored in file geodatabase and is a single-user database (only one user can edit a feature class at a time). This is the MASTER COPY: \\env.gov.ab.ca\gis\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping
- A Westslope Cutthroat Trout Tool and User Guide has been developed by Don Page of RIU– the WSCT Mapping Tool is an add-in for ArcMap that allows users to apply stream tracing, genetic attribution, split hydrology at sites and quality control checks to the spatial data set.
- Species presence is verified through AEP's FWMIS data, current and historical species or location-specific data, stocking records or other available data.
- Barrier information included in the dataset represents barriers identified directly by Fisheries Management (historic and recent data) or consultants working directly for Fisheries Management (Interior Reforestation Co Ltd, Lotic Environmental, Alberta Conservation Association) while conducting WSCT inventory work. As such, the barrier dataset may not be comprehensive and inclusive of all barriers present on the landscape.
- The quality, quantity and timeliness of data are assessed as per the metrics presented above. A record of the data reliability ranking and associated rationale is maintained for each genetic status assessment.
- In general, the most precise genetic data will supersede older, inexact genetic data, as per the guidance specified in Table 3. Data age, sample size, type of genetic analysis technique used, and confidence in the power of admixture detection are important considerations in determining which data to use to delineate genetic status.
- A known sampling site or barrier is required between stream segments of different genetic categories.
- 'All Fish Species Status Unknown' category – This category represents a data deficiency in which no fish species are known to have been captured, observed or stocked. This category could imply habitat limitations to support fish or a lack of sufficient sampling effort.
- The two data deficient categories ("All Fish Species Status Unknown" and "WSCT Status Unknown") will still be associated with a management outcome. Include the two categories internally; however, a combined category such as "potential recovery habitat" or "potential expansion of range" may be used for an external version of the GDP map with broader distribution.
- Confidence in the results of genetic analysis is higher for the solid lines and less certain for the dashed lines.
- Professional discretion may be used to adjust rules based on scale and other available information e.g., species composition. Where professional discretion is used to adjust a rule, the rationale must be documented in the accompanying spreadsheet.
- The coding applies to all mapped and unmapped tributaries. Deals with issues of scale if someone is looking at a more detailed hydro layer for example.

- The hydro layer is sourced from Alberta's Fish & Wildlife Management Information System (FWMIS) and may not reflect recent changes to the stream layer (e.g. post-flood flow alterations).
- From the FSI rule set: "A zero represents a functionally extirpated population (e.g. no fish were detected in recent history, or extirpation is suspected). While a few individuals may still occur in a functionally extirpated population, it is not thought to constitute a viable population".
- Historic range has been based on Dave Mayhood's map in the recovery plan (his information sources are documented in the RP).
- The precautionary management principle was considered and applied in the formation of the genetic ruleset and resultant spatial product, as per the guidance in AEP's Fish Conservation and Management Strategy for Alberta (2014).
- This product will be used to outline current day presence and genetic purity of populations that in turn will be utilized to help feed data into the Fish Sustainability Index (FSI) process. The FSI will be linked to the Fish Conservation Strategy and help in setting Fisheries Management Objectives.

Stocked Populations

- There are some pure or probable pure stocked populations which fall within historic range; some are believed to be in areas which were historically fishless (e.g., headwater lakes).
- The reason for the distinction is that these populations may be managed for recreational purposes so the FMO may be different.
- As well, in context of the recovery plan, stocked pure strains in formerly fishless areas may not count towards a recovered population within historic range or be considered as part of the COSEWIC listing.
- However, where there is reasonable uncertainty as to the origin of the fish, be precautious - Pick a category and give the level of confidence (e.g., high confidence pure or low confidence pure etc.).
- Populations thought to have been native pure but that have been stocked upon with WSCT at some point in past, will be treated as "pure" and not "stocked pure".

Additional Reference Documents:

Allen, B., M. Anderson, J.A. Mee, M. Coombs, and S.M. Rogers. 2016. The role of genetic background in the introgressive hybridization of Rainbow Trout (*Oncorhynchus mykiss*) with Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) in Alberta, Canada, Conservation Genetics.

Allendorf, F. W., R. F. Leary, N. P. Hitt, K. L. Knudsen, L.L. Lundquist, P. Spruell. 2004. Intercrosses and the US Endangered Species Act: should hybridized populations be included as westslope cutthroat trout? Conservation Biology 18(5): 1203-1213.

Elliott, J. M. 1986. Spatial distribution and behavioural movements of migratory trout *Salmo trutta* in a Lake District stream. The Journal of Animal Ecology 907-922.

Elliott, J. 1990. Mechanisms Responsible for Population Regulation in Young Migratory Trout, *Salmo trutta*. III. The Role of Territorial Behaviour. Journal of Animal Ecology 59(3): 803-818.

Fausch, K. D., B. E. Rieman, J. B. Dunham, M. K. Young and D. P. Peterson. 2009. Invasion versus Isolation: Trade-Offs in Managing Native Salmonids with Barriers to Upstream Movement. Conservation Biology 23(4): 859-70.

Gowan, C., and K. D. Fausch. 2002. Why do foraging stream salmonids move during summer? Environmental Biology of Fishes 64:139–153.

Kirk, H., and J. R. Freeland. 2011. Applications and implications of neutral versus non-neutral markers in molecular ecology. International Journal of Molecular Sciences 12(6): 3966-3988.

Kovach, R., C. Muhlfeld, M. Boyer, W. Lowe, F. Allendorf, and G. Luikart. 2014. Dispersal and selection mediate hybridization between a native and invasive species. Proc. R. Soc. B, 282, 9-9.

Mayhood, D. W. and E. B. Taylor. 2011. Contributions to a recovery plan for Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) in Alberta: distribution, population size and trends. Report prepared for Fish & Wildlife Division, Alberta Sustainable Resource Development, by Freshwater Research Limited. FWR Technical Report No. 2011/06-1, Calgary, AB. vi+47pp. + Appendix.

Paul, A. J. and J. R. Post. 2001. Spatial distribution of native and non-native salmonids in streams of the eastern slopes of the Canadian Rocky Mountains. Transactions of the American Fisheries Society 130:3.

Pritchard, V. L., K. Jones, and D. E. Cowley. 2007. Estimation of introgression in cutthroat trout populations using microsatellites. Conservation Genetics 8(6): 1311-1329.

Rasmussen, J.B., M.D. Robinson and D.D. Heath. 2010. Ecological consequences of hybridization between native Westslope Cutthroat (*Oncorhynchus clarkii lewisi*) and introduced Rainbow (*Oncorhynchus mykiss*) Trout: effects on life history and habitat use. Canadian Journal of Fisheries and Aquatic Sciences 67(2): 357–370.

Rodríguez, M.A. 2010. A modeling framework for assessing long-distance dispersal and loss of connectivity in stream fish. pp. 263-279 in: Community Ecology of Stream Fishes, Gido, K., and D. Jackson (eds.), American Fisheries Society, Bethesda, Maryland.

The Alberta Westslope Cutthroat Trout Recovery Team. 2013. Alberta Westslope Cutthroat Trout Recovery Plan: 2012-2017. Alberta Environment and Sustainable Resource Development, Alberta Species at Risk Recovery Plan No. 28 Edmonton, AB: 77pp.

Utah Division of Wildlife Resources. 2000. Cutthroat trout management: a position paper. Genetic considerations associated with cutthroat trout management. Utah Division of Wildlife Resources, Publication 00-26, Salt Lake City. 12pp.

Yau, M. M. and E.B. Taylor. 2013. Environmental and Anthropogenic Correlates of Hybridization between Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*) and Introduced Rainbow Trout (*Oncorhynchus. mykiss*). Conservation Genetics 14(4): 885-900.

Appendix: Ruleset Flowchart

Helpful Tips

- Stream segment = continuous stream length, not including tributaries (important when determining which microsatellite data points are overridden by SNP data)
- A genetic point is only used to code stream segments upstream of that point; EXCEPTION – coding between a permanent barrier downstream of a genetic point on the same stream segment
- The genetic category of the hydro layer may only change at a permanent barrier or a genetic sample site

Identify stream segment you wish to code:

1. Determine if stream segment occurs downstream of any genetic sampling points
    a. No, segment is upstream of all genetic sampling points > go to step 2
    b. Yes, segment occurs downstream of a genetic sampling point > go to step 5
2. Identify the number of genetic sites on the stream segment
    a. Zero > go to step 3
    b. One or more > go to step 5
3. Identify the next downstream break
    a. Barrier > go to step 4
    b. Genetic point > go to step 5
4. Use FWMIS records and local knowledge to identify species composition in the stream segment
    a. No records known or available > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'ALL FISH SPECIES STATUS UNKNOWN'**
    b. No confirmed records of WSCT, but other fish species have been captured or observed > **CODE STREAMS AND TRIBUTARIES UPSTREAM OF THE PERMANENT BARRIER TO 'WSCT STATUS UNKNOWN'**
5. Identify the number of genetic sites on the stream segment
    a. One > go to step 6
    b. More than one > go to step 7
6. Select all stream segments upstream of the identified genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or permanent barrier and/or next upstream genetic point)
    a. If confidence in genetic sampling point is high > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8
    b. If confidence in genetic sampling point is low > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - LOW CONFIDENCE DASHED LINE** > go to step 8
    c. After coding stream based on A or B, go to step 11
7. Identify all genetic points on the stream segment and their relevance (see Rule 1)
    a. More than one high confidence genetic point > Separately for each point, select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO **GENETIC POINT CATEGORY** - HIGH CONFIDENCE SOLID LINE** > go to step 8
    b. More than one low confidence genetic point > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the

most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO *_GENETIC POINT CATEGORY_* - LOW CONFIDENCE DASHED LINE** > go to step 8

****Reminder – override microsatellite points that occur upstream of SNP data points on the same stream segment. Microsatellite data points occurring on separate stream segments remain valid and can be used for coding.**

c. Both high and low confidence genetic points > Separately for each point, select all stream segments upstream of the individual low confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO *_GENETIC POINT CATEGORY_* - LOW CONFIDENCE DASHED LINE** > select all stream segments upstream of the individual high confidence genetic point to the most upstream extent encountered (Strahler Order 1 streams and/or barrier and/or next upstream genetic point) > **CODE STREAMS AND TRIBUTARIES TO *_GENETIC POINT CATEGORY_* - HIGH CONFIDENCE SOLID LINE** > go to step 8

8. Identify any permanent barrier(s) on the stream segment, downstream of the genetic point used in coding, but upstream of any addition genetic points
   a. No permanent barrier(s) exist > no changes required
   b. One permanent barrier exists > select all stream segments upstream of the permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP**
   c. More than one permanent barrier exists > select all stream segments upstream of the most upstream permanent barrier to the genetic point > **CODE STREAM AND TRIBUTARIES TO THE SAME CATEGORIES USED IN THE PREVIOUS STEP** > select all stream segments downstream of the most upstream permanent barrier to the next downstream permanent barrier > **CODE STREAM AND TRIBUTARIES TO *_SAME GENETIC CATEGORY USED IN PREVIOUS STEP_* - LOW CONFIDENCE DASHED LINE**

Tuesday, February 12, 2019 2:44 PM

1. Pure - High Confidence segments (P-HC)
    a. SNP tested point upstream, ≥16 fish sampled.
    b. SNP tested point downstream to permanent barrier, <16 fish sampled.
2. Pure - Low Confidence (P-LC) Pure segments
    a. SNP or MS tested point upstream, ≥16 fish sampled.
    b. SNP or MS tested point downstream to permanent barrier, <16 fish sampled.
    c. Segments where WSCT are present, no genetic information exists, and
        i. they are suspected pure
        ii. upstream of a permanent barrier
    a. Segments where WSCT or all fish species presence is unknown
        i. they are suspected present, and pure
        ii. upstream of a permanent barrier

1. Near Pure - High Confidence Near Pure
    a. Near Pure - High Confidence segments that are contiguous with upstream Pure - High Confidence segments (based of potential for recovery and the precautionary principle)
2. Areas of Critical Habitat identified in Recovery Strategy (2014)
    a. If previous CH and remains High or Low confidence Pure: keep and extend to tributaries upstream
    b. If previous Critical Habitat stream segments are now High or Low confidence Pure, segments will be extended and their tributaries will be included as Critical Habitat (based of potential for recovery and the precautionary principle)

1. "All Fish Species Status Unknown" upstream of Critical Habitat segments (rules 1-4) (ecological integrity and precautionary principle)

Text Legend for Notes
Black text - AG notes
Red text -EW notes
Green text - EW & AG discussion/final decision

Wednesday, February 13, 2019 10:31 AM

INCLUDE

Lynx - and trib to Lynx
-prev categorized as CH
-microsat data indicates pure, SNP - NP with HC
-in or out? FMO?
-should this be kept in as a recoverable area?
KEEP (precautionary) (EW)
Keep as recoverable area

Snowshoe creek
-prev ID as CH (2104)
- Upper reach is pure LC, downstream is NP based on SNPs.
- -same as Lynx

KEEP (precautionary) (EW)
Keep as recoverable area

Goat
-trib of Goat was on 2014 CH list
-same situation as Snowshoe
KEEP (precautionary) (EW)
Keep as recoverable area

Lost/North Lost/South Lost Creek
-Lost and tribs to North Lost was on 2014 CH list
- Keep the pure HC
- KEEP pure HC and include pure LC (EW)
- Keep as recoverable area

Macdonald Creek
-CH in 2014
-changed from pure to pure LC
-why is it LC, looks like there was a pure SNP and pure microsat sample
Keep?
Less than 15 samples, so that's why it's LC, should keep as CH
KEEP (EW)
Keep

Syncline Brook
-2014 CH
-now NP based on SNPs
-keep as recoverable area or out bc downstream is hybrid, doesn't look like there's a barrier downstream?
-no barrier, but goes seasonably dry, so seasonal barrier
KEEP as previous CH
Best avail sci NP, but include as recovery area
Extend upstream to NFD area

Carbondale
-NP
INCLUDE previous CH (EW)
Include as recovery area
Expand upstream into NFD area

O'Haggen Creek
-CH in 2014
-extend to new reaches as pure/CH
Yes (EW)
keep

West Castle River + trib to
-2014 CH list (smaller segment)
-still pure
-extend
Yes (EW)
keep

Scarpe Creek
-new CH based on pure SNP HC sample
Yes (EW)
Add pure as CH, add LC NP as recovery CH

South Castle River
-2014 CH
-still pure HC based on SNP
Yes (EW)
Keep Pure, add LC NP as recovery CH

Font Creek
-trib to South Castle
-new
-pure HC based on SNP HC sample
Yes (EW)
Add as CH

DO NOT INCLUDE

Webb Creek

Mill Creek

Jutland Brook
-NFD area
-do not include bc flows into NP LC

Wednesday, February 13, 2019 10:59 AM

INCLUDE

York Creek
- pure LC - no genetic info but WSCT captured/observed
-genetic category unknown
-includes North York
-no fish caught but sampled, rule set says to include if historic info, so add to CH
Yes, add to CH (EW)
Add to CH

Trib to Blairmore Creek
-a small segment of a trib to Blairmore Creek was on the 2014 CH list
-now NP LC based on SNP
-all hybrid downstream
Remove 2014 CH, do not add as CH bc its LC NP with connecting hybrid

Gold Creek
-includes Caudron, Morin, Green Creeks
-Gold and Caudron, small d/s segment Green Creek, small d/s segment Morin were on 2014 CH list
-combo of pure HC and pure LC based on SNP and microsat samples
some spots with lots of fish and some with only a few fish. No reason to believe that there are NP fish here, keep as CH/expand
Yes, keep and expand (EW)
Add CH, expand
Include Green Creek (NFD) trib to Gold Creek

Trib to Rock Creek
-2014 CH
-pure HC, NP HC and pure LC in cluster
-thoughts would be to have this whole segment as CH, up to the downstream barrier?
Yes, have whole segment as CH up to downstream barrier (EW)
-Add/keep CH in pure HC and pure LC, NP HC up to the barrier

Allison Creek
-was 2104 CH
-now all NP
Remove 2014 CH, do not add as CH bc its LC NP with connecting hybrid

Girardi Creek
-2014 CH (smaller segment)
-expand CH
-pure HC based on SNP
Yes (EW)
CH

Star Creek
-2014 CH (smaller segment)
-pure HC and pure LC
-expand CH into both HC and LC areas to d/s barrier
Yes (EW)
CH

DO NOT INCLUDE

Todd Creek
-trib to was 2014 CH
-now whole area is hybrid
- Was pure in smaller segment based on microsats, now hybrid based on SNP
- Hybrid with high confidence, not a top priority for recovery so remove from CH
- Yes, remove from CH (EW)
- -remove as CH

Goat Creek

Wednesday, February 13, 2019 11:11 AM

Cougar Creek
-pure LC based on SNP and in upper reaches no fish above barriers (multiple)
-add as CH -precautionary?
-low sample numbers, barrier
For Discussion: add as CH based on LP and presence of fish (follow rule-set, precautionary) (EW)
Add Pure LC as CH, include NFD area upstream

Piper Creek
-pure LC based on SNP
-no barrier between pure LC and NP LC (SNP tested for NP LC far downstream)
-add in as new CH -precautionary
Very low confidence, only 1 fish
For discussion - areas above barrier: known fish or unknown? Tentative Yes.
Add pure LC as CH

Upper Elbow
-add pure LC as CH

Prairie Creek
-pure LC based on microsat
- added as new CH
-precautionary
Until SNP samples taken
1 sample just under the cut off for pure
Keep as pure based on precautionary and previous 2014 CH (EW)
Add pure LC include the NP tribs

Ford Creek
-new CH
-pure HC based on SNP
Yes (EW)
Add CH

Silvester Creek
-2014 CH
-pure HC based on SNP
-expand CH into upper reaches
-include above barrier no fish (purple dash)
Yes (EW)
For discussion:
extend to no-fish above barrier (not in rule set, tenative NO)
Keep CH, add the NFD trib

Wednesday, February 13, 2019 11:21 AM

Waiparous Creek
-2014 CH
-extend CH into pure LC area
-include all tribs, even Aura (NP HC based on SNP)
-Aura, Four Mile, Lost Knife Creek, Meadow Creek, Johnson Creek, Margaret Creek, Lookout Creek, Mocking bird creek
- **NEED DISCUSSION regarding Aura (not included in 2014?).**
Yes to all else.

-most of the trips are pure LC, but precautionary approach would be to include them
Low confidence along stream bc not many fish caught
There are 2018 samples that are currently being analyzed and they are re-testing the NP site, re-evaluate CH extent after analysis

South Ghost River
- Need higher confidence to include as CH
- Exclude for now
- Not include as CH

Upper Ghost River
-need more sampling/higher confidence to include
-exclude for now
Not include as CH

Wednesday, February 13, 2019 11:28 AM

include

Lantern Creek
-upper segment pure HC
-add as new CH above barrier
This was a 2007 microsat point, so low confidence.
Yes, Add upper segment as CH above barrier.
Add CH

Odlum Creek
-pure LC based on SNPs
-add as new CH (precautionary)
Yes, add as CH based on ruleset (precautionary) (EW)
Add CH

Baril Creek
-pure upstream of barrier based on pure HC SNP, further upstream pure LC based on SNP
-add as new CH into pure LC areas
Yes, add as new CH **(EW)**
Include CH, up to NP HC

Ethrington Creek
-add as new CH (precautionary)
-pure HC and pure LC based on microsat and SNP (LC)
yes, as precautionary until SNP sample taken
Low confidence but still pretty sure the pure WSCT are being detected
Yes, add LC above barriers as CH (EW)
-include CH, including the NP LC trib

Cataract Creek
-includes tribs: Lost Creek, Cummings Creek, Salter Creek, Wilkinson Creek
-all except Wilkinson are pure LC up to the barriers downstream
-wilkinson is pure HC based on SNP
-assume that the other waterbodies that are connected as pure LC based on the HC sample at Wilkinson
High confidence at wilkinson, so the status is based on the status above the barrier and assume that any WSCT would be pure thru out the rest of the system
ADD Wilkinson above barrier (EW)
Include CH

Zephyr Creek
-2014 CH
-pure HC based on SNP
-extend CH
Yes, keep and extend (EW)
Include CH

Cutthroat Creek
-2014 CH
-pure based on SNP HC
-keep, and expand CH up to barrier
Yes, keep and extend (EW)
Include CH

Do not include

Loomis Creek

Salt Creek
-do not include NP HC or NP LC area
-goes into hybrid

Head creek

Trib to Flat Creek
-2014 CH
-2014 category based on microsat
-SNP puts it into hybrid but with LC
-no barrier from Highwood river, so recommend removing from CH list
Assume that they are all hybrid now
Remove bc now hybrid

Deep creek
-2014 CH
-was pure, now based on SNP is hybrid with HC
-remove from CH list
-direct connection to Highwood River (hybrid) with no barrier)
Older microsat points, hybrid now with high confidence (85% pure)
REMOVE from CH based on SNP hybrid (EW)
Remove bc now hybrid

Tuesday, February 12, 2019 2:44 PM

Low confidence
-could be areas where a small number of fish are sampled. i.e 1 fish using 34 diagnostic loci SNPs, then 28.9% confident that they can identify a 0.5% admixture in that individual

-earlier data obtained thru microsat analysis, bc it used non-diagnostic loci. Prev conducted mircosat analysis will still be used to ID genetic category but they will be categorized as having low confidence

-segments where WSCT are present but no genetic info exists, but suspected pure. Generally above barriers
Segments where WSCT or all fish presence unknown

High confidence
-stream segments coded using SNP tested data, confidence in detecting 0.5% genetic admixture (sample sites >16 fish)
-includes high confidence SNP points to the next upstream extent, including 1st order and/or perm barrier and/or next genetic site
-downstream from high confidence SNP to perm barrier on the same segment, providing no other SNP genetic points exist in between

Current ~~Previous~~ CH (2014) (EW)
-if ~~previous~~ CH and remains HP or LP: keep and extend to tributaries upstream
-if ~~previous~~ CH and becomes NP: keep based on precautionary principle
If 2014 CH now Hybrid, do not include

NP adjacent to Pure
-include if NP is adjacent to pure. based on precautionary principle and recovery potential

Wednesday, February 13, 2019 10:31 AM

INCLUDE

Lynx - and trib to Lynx
-prev categorized as CH
-microsat data indicates pure, SNP - NP with HC
-in or out? FMO?
-should this be kept in as a recoverable area?
-no recovery actions planned by AEP, so likely out as CH
KEEP (precautionary) (EW)
Keep as recoverable area

Snowshoe creek
-prev ID as CH (2104)
- Upper reach is pure LC, downstream is NP based on SNPs.
- Keep if thought to be recoverable area?
- -same as Lynx

KEEP (precautionary) (EW)
Keep as recoverable area

Goat
-trib of Goat was on 2014 CH list
-same situation as Snowshoe
-keep as recoverable or out bc of SNP data?
KEEP (precautionary) (EW)
Keep as recoverable area

Lost/North Lost/South Lost Creek
-Lost and tribs to North Lost was on 2014 CH list
- Keep the pure HC
- -include pure LC?
- KEEP pure HC and include pure LC (EW)
- Keep as recoverable area

Macdonald Creek
-CH in 2014
-changed from pure to pure LC
-why is it LC, looks like there was a pure SNP and pure microsat sample
Keep?
Less than 15 samples, so that's why it's LC, should keep as CH
KEEP (EW)
Keep

Syncline Brook
-2014 CH
-now NP based on SNPs
-keep as recoverable area or out bc downstream is hybrid, doesn't look like there's a barrier downstream?
-no barrier, but goes seasonably dry, so seasonal barrier
KEEP as previous CH
Best avail sci NP, but include as recovery area
Extend upstream to NFD area

Carbondale
-NP
-do not include
INCLUDE previous CH (EW)
Include as recovery area
Expand upstream into NFD area

O'Haggen Creek
-CH in 2014
-extend to new reaches as pure/CH
Yes (EW)
keep

West Castle River + trib to
-2014 CH list (smaller segment)
-still pure
-extend
Yes (EW)
keep

Scarpe Creek
-new CH based on pure SNP HC sample
Yes (EW)
Add pure as CH, add LC NP as recovery CH

South Castle River
-2014 CH
-still pure HC based on SNP
Yes (EW)
Keep Pure, add LC NP as recovery CH

Font Creek
-trib to South Castle
-new
-pure HC based on SNP HC sample
Yes (EW)
Add as CH

Jutland Brook
-NFD area
-add to CH, indirect CH

DO NOT INCLUDE

Webb Creek

Mill Creek

INCLUDE

York Creek
- pure LC - no genetic info but WSCT captured/observed
-genetic category unknown
-keep?
-includes North York
-no fish caught but sampled, rule set says to include if historic info, so add to CH
Yes, add to CH (EW)
Add to CH

Trib to Blairmore Creek
-a small segment of a trib to Blairmore Creek was on the 2014 CH list
-now NP LC based on SNP
-remove from CH?
-all hybrid downstream
FOR DISCUSSION: Keep as CH based on previous pure (precautionary)
Remove 2014 CH, do not add as CH bc its LC NP with connecting hybrid

Gold Creek
-includes Caudron, Morin, Green Creeks
-Gold and Caudron, small d/s segment Green Creek, small d/s segment Morin were on 2014 CH list
-combo of pure HC and pure LC based on SNP and microsat samples
-keep and expand as CH?
-do we include the upstream segment of green, above barrier where no fish documented? Thoughts are yes, if no fish, could be indirect CH
-some spots with lots of fish and some with only a few fish. No reason to believe that there are NP fish here, keep as CH/expand
Yes, keep and expand (EW)
Add CH, expand
Include Green Creek (NFD) trib to Gold Creek

Trib to Rock Creek
-2014 CH
-pure HC, NP HC and pure LC in cluster
-thoughts would be to have this whole segment as CH, up to the downstream barrier?
Yes, have whole segment as CH up to downstream barrier (EW)
Add/keep CH in pure HC and pure LC. NP HC up to the barrier

Allison Creek
-was 2104 CH
-now all NP
DISCUSSION: remove or keep portion that was previously designated as CH? All NP above barrier as recovery?
Remove 2014 CH, do not add as CH bc its LC NP with connecting hybrid

Girardi Creek
-2014 CH (smaller segment)
-expand CH
-pure HC based on SNP
Yes (EW)
CH

Star Creek
-2014 CH (smaller segment)
-pure HC and pure LC
-expand CH into both HC and LC areas to d/s barrier
Yes (EW)
CH

DO NOT INCLUDE

Todd Creek
-trib to was 2014 CH
-now whole area is hybrid
- Was pure in smaller segment based on microsats, now hybrid based on SNP
- What is the FMO for this area? Is it worth keeping as CH, to restore the population? Is it unique? Or out, based on hybrid status
- Hybrid with high confidence, not a top priority for recovery so remove from CH
- Yes, remove from CH (EW)
- remove as CH

Goat Creek

Cougar Creek
-pure LC based on SNP and in upper reaches no fish above barriers (multiple)
-add as CH -precautionary?
-low sample numbers, barrier
For Discussion: add as CH based on LP and presence of fish (follow rule-set, precautionary) (EW)
Add Pure LC as CH, include NFD area upstream

Piper Creek
-pure LC based on SNP
-no barrier between pure LC and NP LC (SNP tested for NP LC far downstream)
-add in as new CH -precautionary?
Very low confidence, only 1 fish
For discussion - areas above barrier: known fish or unknown? Tentative Yes.
Add pure LC as CH

Upper Elbow
-add pure LC as CH

Prairie Creek
-pure LC based on microsat
-could be added as new CH
-precautionary? Until SNP samples taken
1 sample just under the cut off for pure
Keep as pure based on precautionary and previous 2014 CH (EW)
Add pure LC include the NP tribs

Ford Creek
-new CH
-pure HC based on SNP
Yes (EW)
Add CH

Silvester Creek
-2014 CH
-pure HC based on SNP
-expand CH into upper reaches
-include above barrier no fish (purple dash)
Yes (EW)
For discussion:
extend to no-fish above barrier (not in rule set, tenative NO)
Keep CH, add the NFD trib

Wednesday, February 13, 2019 11:21 AM

Waiparous Creek
-2014 CH
-extend CH into pure LC area
-how far downstream do we go? Where it connects to the Ghost?
-include all tribs, even Aura (NP HC based on SNP)
-Aura, Four Mile, Lost Knife Creek, Meadow Creek, Johnson Creek, Margaret Creek, Lookout Creek, Mocking bird creek
- **NEED DISCUSSION regarding Aura (not included in 2014?).**
Yes to all else.
-most of the trips are pure LC, but precautionary approach would be to include them
Low confidence along stream bc not many fish caught
There are 2018 samples that are currently being analyzed and they are re-testing the NP site

Option/Map 1: keep maps in line with AEP's fishery management objectives, use their recovery areas map and include Ghost up to junction with South Ghost

Option/Map 2: CH extend to junction of Waiparous and Ghost. WHY??

Note: genetic samples for upper Ghost should be in March 2019. Pure HC might be extended to upper Ghost

South Ghost River
- Need higher confidence to include as CH
- Exclude for now?
- **NEED DISCUSSION what is the basis for decision?**
- Not include as CH, based on FMOs

Upper Ghost River
-need more sampling/higher confidence to include
-exclude for now?
NEED DISCUSSION: leaning towards exclusion (no fish)
Not include as CH, based on FMOs

include

Lantern Creek
-upper segment pure HC
-add as new CH above barrier
This was a 2007 microsat point, so low confidence. It was left out of the 2014 CH
Yes, Add upper segment as CH above barrier.
Add CH

Odlum Creek
-pure LC based on SNPs
-add as new CH (precautionary)
Yes, add as CH based on ruleset (precautionary) (EW)
Add CH

Baril Creek
-pure upstream of barrier based on pure HC SNP, further upstream pure LC based on SNP
-add as new CH into pure LC areas
Yes, add as new CH **(EW)**
DISCUSSION - area above barriers **(EW)**
Include CH, up to NP HC

Ethrington Creek
-add as new CH (precautionary)
-pure HC and pure LC based on microsat and SNP (LC)
-do we include the trib on ethrington that is NP LC based on microsat?
Thoughts are yes, as precautionary until SNP sample taken
Low confidence but still pretty sure the pure WSCT are being detected
Yes, add LC above barriers as CH (EW)
FOR DISCUSSION: area not added in 2014. Leave as NOT CH (EW)
-include CH, including the NP LC trib

Cataract Creek
-includes tribs: Lost Creek, Cummings Creek, Salter Creek, Wilkinson Creek
-all except Wilkinson are pure LC up to the barriers downstream
-wilkinson is pure HC based on SNP
-assume that the other waterbodies that are connected as pure LC based on the HC sample at Wilkinson
-include this whole node as new CH?
High confidence at wilkinson, so the status is based on the status above the barrier and assume that any WSCT would be pure thru out the rest of the system
ADD Wilkinson above barrier (EW)
FOR DISCUSSION: Cataract Creek above barrier and rest of system. No genetic information downstream of barrier on Wilkinson. Suggest leaving as not CH. (EW)
Include CH

Zephyr Creek
-2014 CH
-pure HC based on SNP
-extend CH
Yes, keep and extend (EW)
Include CH

Cutthroat Creek
-2014 CH
-pure based on SNP HC
-keep, and expand CH up to barrier
Yes, keep and extend (EW)
Include CH

Do not include

Loomis Creek

Salt Creek
And trib?
-do not include NP HC or NP LC area
-goes into hybrid

Head creek

Trib to Flat Creek
-2014 CH
-2014 category based on microsat
-SNP puts it into hybrid but with LC
-no barrier from Highwood river, so recommend removing from CH list
Assume that they are all hybrid now
FOR DISCUSSION: once have overlay maps, need to see 2014 and basis. Is this a case where was pure but now not? Tentative remove from CH (EW)
Remove bc now hybrid

Deep creek
-2014 CH
-was pure, now based on SNP is hybrid with HC
-remove from CH list?
-direct connection to Highwood River (hybrid) with no barrier)
Older microsat points, hybrid now with high confidence (85% pure)
REMOVE from CH based on SNP hybrid (EW)
Remove bc now hybrid

Wednesday, February 13, 2019 11:42 AM

Unnamed Trib to Jumpingpound Creek
-2014 CH
-2014 category based on microsat
-now NP HC based on SNP
-keep as recoverable population or exclude as CH?
Keep as former CH and NP add tributaries
Keep NP HC, do not include NP LC areas

Lusk Creek
-NP based on microsat, but pure LC based on SNP
-add as new CH or need to do more sampling to increase confidence?
-looks like it flows into a hybrid LC area, with no barriers
-thoughts are to exclude until we have higher confidence
Include based on ruleset (precautionary) EW
Add CH

Do not include

Do not include NP LC trib to JP Creek

Evan Thomas Creek
-2014 CH
-pure HC based on SNP
-CH up to barrier and above into no fish documented area (Elbow-Sheep Wildland area)
-expand CH
Expand CH (EW)
Expand CH, include NFD area upstream

Do not include

Flat Creek
-is this a pure HC creek? Can't see a sample point
No
Not CH / Pure (EW)

Spotted Wolf

Pocaterra -overridden by SNP
Not CH / pure (EW)
Not include as CH

Foch Creek, Three Isle Creek , Upper Kananaskis River, Maude Brook, Headwall Creek, Ribbon Creek
-all pure LC, no sample points
-exclude until samples taken
-stocking records of the high mountain lakes, so LC pure
FOR DISCUSSION - using or not using rules?
Not include as CH, bc stocked population in high alpine lakes

Headwall Creek

Ribbon Creek

Wednesday, February 13, 2019 12:31 PM

Beaver Creek (upper reach)

- Pure HC based on a lot of SNP samples
- -stop CH at pure HC area or NP HC area?
- After that it transitions into hybrid LC
- Is there a barrier at this point?
- -why is it hybrid LC below this point
- Include HC Pure and NP (adjacent to pure, precautionary) (EW)
- Include as CH, up to NP HC

Wednesday, February 13, 2019 1:20 PM

Corral Creek
-pure LC based on SNPs
-recommend not including as CH until more sampling/higher confidence
-downstream is hybrid with no barriers
ADD tribs to Corral Creek (2014 CH) (EW)
FOR DISCUSSION - another creek?
Keep and extend, include nearby Trib

Lower Iron Creek
-Not CH 2014. Hybrid above
DO NOT ADD (EW)
Not include bc hybrid d/s of LC pure

Hidden Creek (unnamed tributary to)	Gorge Creek
Hidden Creek	
Isolation Creek	Gold Creek
Johnson Creek	
Jumpingpound Creek (unnamed tributary to)	
Little Fish Lake	Caudron Creek
Livingstone River	
Lookout Creek	
Lyall Creek	
Lynx Creek (unnamed tributary to)	
Lynx Creek	
Macdonald Creek	
Mean Creek	
Mockingbird Creek	
Morin Creek	
North Lost Creek	
North Lost Creek (unnamed tributary to)	
North Racehorse Creek	
North Racehorse Creek (unnamed tributary to)	
North Twin Creek	
Oldman River	O'Haggen
Outlet Creek	
Oyster Creek	
Oyster Creek (unnamed tributary to)	
Pasque Creek	
Picklejar Creek	
Picklejar Lakes (#2 Lake)	
Picklejar Lakes (#4 Lake)	
Prairie Creek	
Rock Creek	
Savanna Creek	
Sawback Lake	
Sharples Creek	
Silvester Creek	
Slacker Creek	

Wednesday, February 13, 2019 12:33 PM

Do not include

Gorge Creek
-2014 CH
-2014 based on microsat
-SNP indicates that it is NP HC
-keep as recoverable area?
Keep and expand to upstream tribs (EW)
Include NP HC as CH, recoverable area

South Coal Creek

Trib to Gorge Creek
-2014 CH
-SNP indicates that it is NP HC
-keep as recoverable area?
Keep and expand to upstream tribs (EW)
Include NP HC as CH, recoverable area

Other Pure LC streams in area:
-Rae, Burns, Cliff, Junction
-all pure LC
-no sample
-recommend not including as CH until more certainty, more samples
FOR DISCUSSION: EW agrees. MC wants to add based on rule set - to be confirmed.
Include P LC, include NDF tribs

Upper Oldman River - inlcudes Trib to Oyster, Oyster, Straight, Pasque, Lyall Creek, Beehive Creek, Cache Creek, Soda Creek, Slacker Creek
-2014 CH (whole segment)
-pure HC
-expand CH into tribs
-stop at barrier below Cache Creek where it turns into NP HC, or continue downstream to junction of Hidden Creek?
-there is no barrier here but after this the SNP samples are hybrid LC
-the segment of the Oldman between Cache and Hidden is NP HC, could be considered recovery habitat
-this segment would also include tribs: Honeymoon Creek (+no fish area above upstream barrier) and Shale Creek (NP HC)
The stretch of NP is 97% NP, they did sampling this year and no WSCT caught, they need to do a little more sampling to get more info. There is high certainty above the barrier
Include the NP as precautionary
Add all and NP (Shale and Homeymoon) as precautionary (adjacent to pure) (EW)
Include all as CH, including NP HC on the upper Oldman R

Hidden and South Hidden Creek
-Hidden and trib to Hidden 2014 CH
-pure LC based on microsat and LC SNP (assuming)?
-propose to include and expand as CH
Based on old microsat data (same as 2014 data), but new samples should be analyzed in a month
Keep and expand (EW)
Include all as CH

Isolation Creek
-2014 CH
-remove as CH?
-based on NP HC SNP sample
Keep based on 2014 CH and precautionary
Include as CH, include NFD upstream

Dutch Creek
-From downstream barrier to either NP LC sample point or to the upstream extent
-include as precautionary or exclude until more certainty
-between these points it's pure HC and pure LC
-OR other option is to only include the Pure HC segment of Dutch creek, where we have high certainty?
NP at the upstream, but only 1 fish so not high confidence
New samples taken, they took samples in the hybrid LC area so there might be more info in that stretch by end of march
Include all as pure, NP adjacent to downstream pure (EW)
Include as CH

Daisy Creek
-the rule set says that Daisy is near pure SNP, but the map shows it as pure HC SNP and NP microsat tested ?
-recommend as CH up to barrier/hybrid category
More info soon
Include all as pure, NP adjacent to downstream pure (EW)
Include as CH, include NP HC trib

Livingston River
-2014 CH
-pure HC
-keep as CH up to NP HC segment
Yes add (EW)
Include all as CH, start at NP HC and extend upstream.
Go upstream to include Dry, Sananna, Mean, Beaver,
Include the NFD areas

Wintering Creek
-add (EW)
-include CH

North Racehorse Creek + South Racehorse
-includes tribs, First Creek, Smith Creek , Spoon Creek
-most of the area is 2014 CH
-downstream to barrier
-include the areas upstream in Smith and Spoon where no fish documented
-expand CH
Yes extend, include adjacent downstream NP based on precautionary (EW)
FOR DISCUSSION - Fishless tribs
-include CH, down to NP HC and NFD (Smith Creek, Spoon)

Dry Creek
-pure HC and no fish documented
-add as new CH
Yes add (EW)
-include as CH, with NFD

Savannna Creek
-2014 CH
-expand CH to include above barrier, no fish documented
-Based on pure HC SNP
Yes extend (EW) (EW)
DISCUSSION - how to treat fishless
-include as CH, with NFD

Mean Creek
-2014 CH
-keep, expand into tribs
-based on pure HC SNP
Yes extend (EW)
-include as CH

Beaver Creek
-2014 CH
-pure HC based on SNP
-keep, expand into tribs
Yes extend (EW)
-include as CH

Speers Creek
-2014 CH
-keep, expand into tribs based on SNP, pure HC
Yes extend (EW)
-include CH

Ridge Creek
-pure HC based on SP
-add as new CH
Yes add (EW)'
-include CH

Deep Creek
-pure HC and pure LC
-add as new CH
Yes extend (EW)
-include CH

White Creek
-2014 CH
-pure HC based on SNP
-keep and expand CH
Yes extend (EW)
-include CH

Playee Creek
-pure HC based on SNP
-add as new CH
Yes add (EW)
-include CH

Sharples Creek
-add the pure HC area as CH
-exclude the NP trib
Yes add (EW)
-include CH, include NP HC trib

Vicary Creek
-2014 CH
-include the pure HC area and the no fish documented area
-expand CH
Yes extend, include adjacent downstream NP based on precautionary (EW)
FOR DISCUSSION - Fishless tribs
-include CH, include the NFD areas

Do not include

Ernst Creek

Watson, Ernest

From: Watson, Ernest
Sent: Monday, February 18, 2019 2:49 PM
To: Boyko, Amy; Bakelaar, Carolyn
Subject: FW: FOR DISCUSSION
Attachments: Castle River.jpg; Castle River FOR DISCUSSION.jpg; 4of21_CastleRiver.pdf

Importance: High

FYI...meant to copy you.

From: Watson, Ernest
Sent: Monday, February 18, 2019 2:40 PM
To: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: FOR DISCUSSION
Importance: High

Exercise:

Andrew produced maps, based on AB shape files, that included

- Pure – Certain
- Pure – uncertain
- Near Pure – Certain
- Near Pure – uncertain
- 2014 CH

For example (relatively simple) watershed, I applied segment rule set applied that is now CH:

- Pure – Low Confidence
- Pure – High Confidence
- Previous CH now designated as "Near Pure" – with CH expanded to tributaries (decision needs to be confirmed)
- CIRCLED IN RED those near pure segments that must be manually deleted

For discussion purposes I have attached the maps for the Castle River watershed:

- Map provided by AB (4of21_CastleRiver.pdf)
- Map produced by Andrew (Castle River.jpg)
- Map marked up by Ernie (Castle River FOR DISCUSSSION.jpg)

If this approach is acceptable, the next step would be for Andrew G / Andrew D to:

- Delete circled segments
- Get coordinates (lat / long) for start / end of every tributary and unnamed tributary for new CH segments.

Ernie.

From: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 12:26 PM

To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: AB Data and Critical Habitat Determination

Accurate – yes, pls proceed. There is one pure section I have asked remain out form the criteria agreed to, Ashley can advise which segment verbally.

Thanks

M

Martyn Curtis

Director, Fish and Fish Habitat Protection & Species at Risk
Fisheries and Oceans Canada
Central and Arctic Region
Government of Canada

Tel | Tél: (204) 983-4223
Fax | Téléc: (204) 983-7983
Email | Courriel: Martyn.Curtis@dfo-mpo.gc.ca

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 10:25 AM
To: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: AB Data and Critical Habitat Determination
Importance: High

Martyn, I am working with Andrew to sort out the mapping. Based out our conversation Friday and yesterday, it is my understanding that you and AEP (Craig and Sue) discussed and agreed on the following with respect to the designation of WSCT CH.

Based on the new single nucleotide polymorphism (SNP) and older microsatellite (MS) genetic data, the following rule set has been developed to designate stream segments:

Pure - Low Confidence:

- SNP data indicates pure, small number of fish were sampled (<16 fish sampled)
- Previous MS indicates pure, no new SNP data
- Segments where WSCT are present, but segments where WSCT are present but no genetic info exists, but suspected pure. Generally above barriers

Pure – High Confidence

- SNP indicates pure, >16 fish sampled
- SNP points to the next upstream extent, including 1st order and/or perm barrier and/or next genetic sampling site
- downstream from high confidence SNP to perm barrier on the same segment, providing no other SNP genetic points exist in between

WSCT Critical Habitat - the following stream segments will be considered CH:

- **Pure – Low Confidence**
- **Pure – High Confidence**
- **Previous CH now designated as "Near Pure"**

All other stream segments not falling into the above categories would not be designated as CH, including:

- Near Pure – High and Low confidence (*unless previously designated CH as indicated above)
- Hybrid – High and Low Confidence (even if previously designated as CH)
- Segments above barriers where no WSCT or fish have been documented.

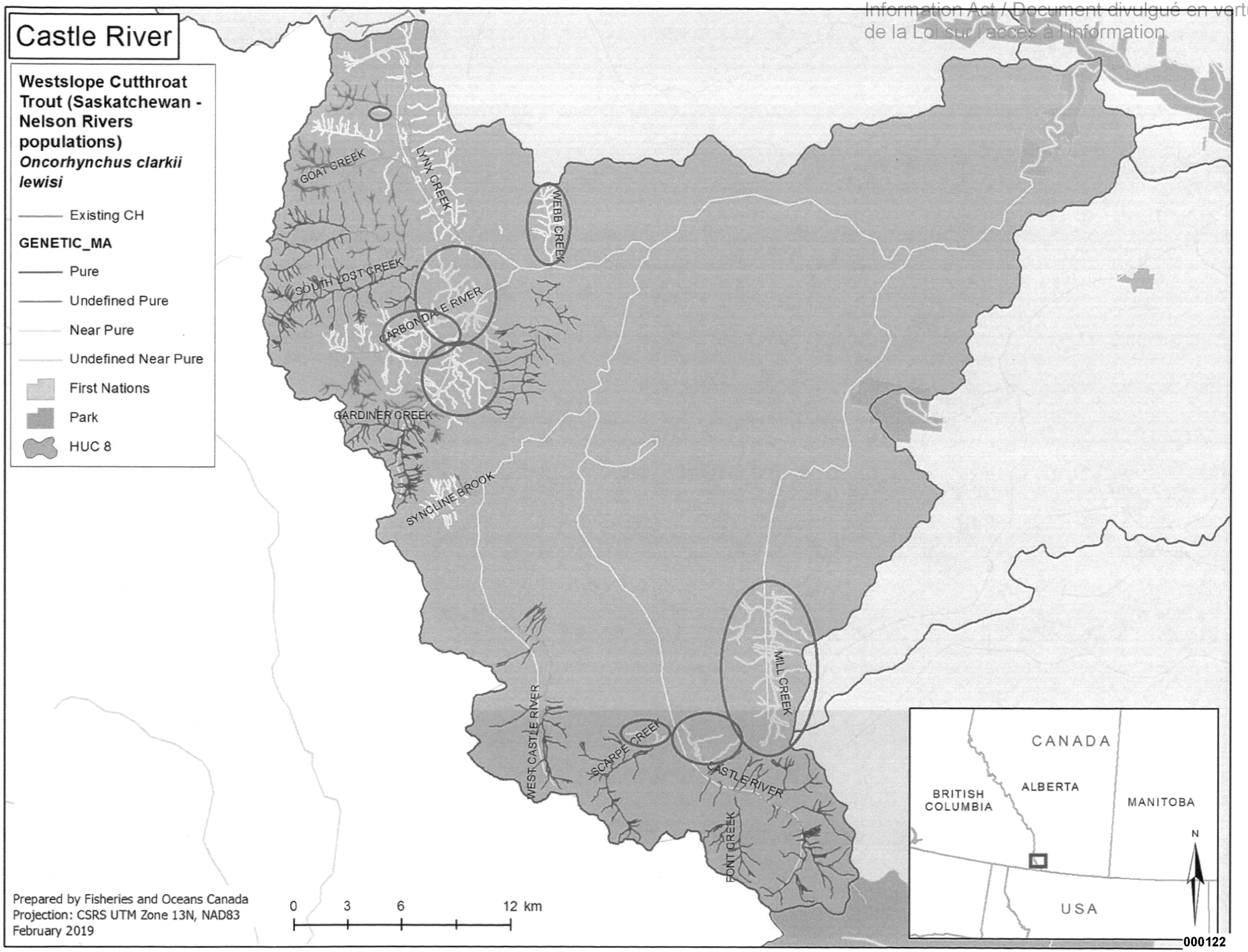
Please confirm that this is accurate.

Thanks, Ernie.

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611



Alberta Environment and Parks, South Saskatchewan Region

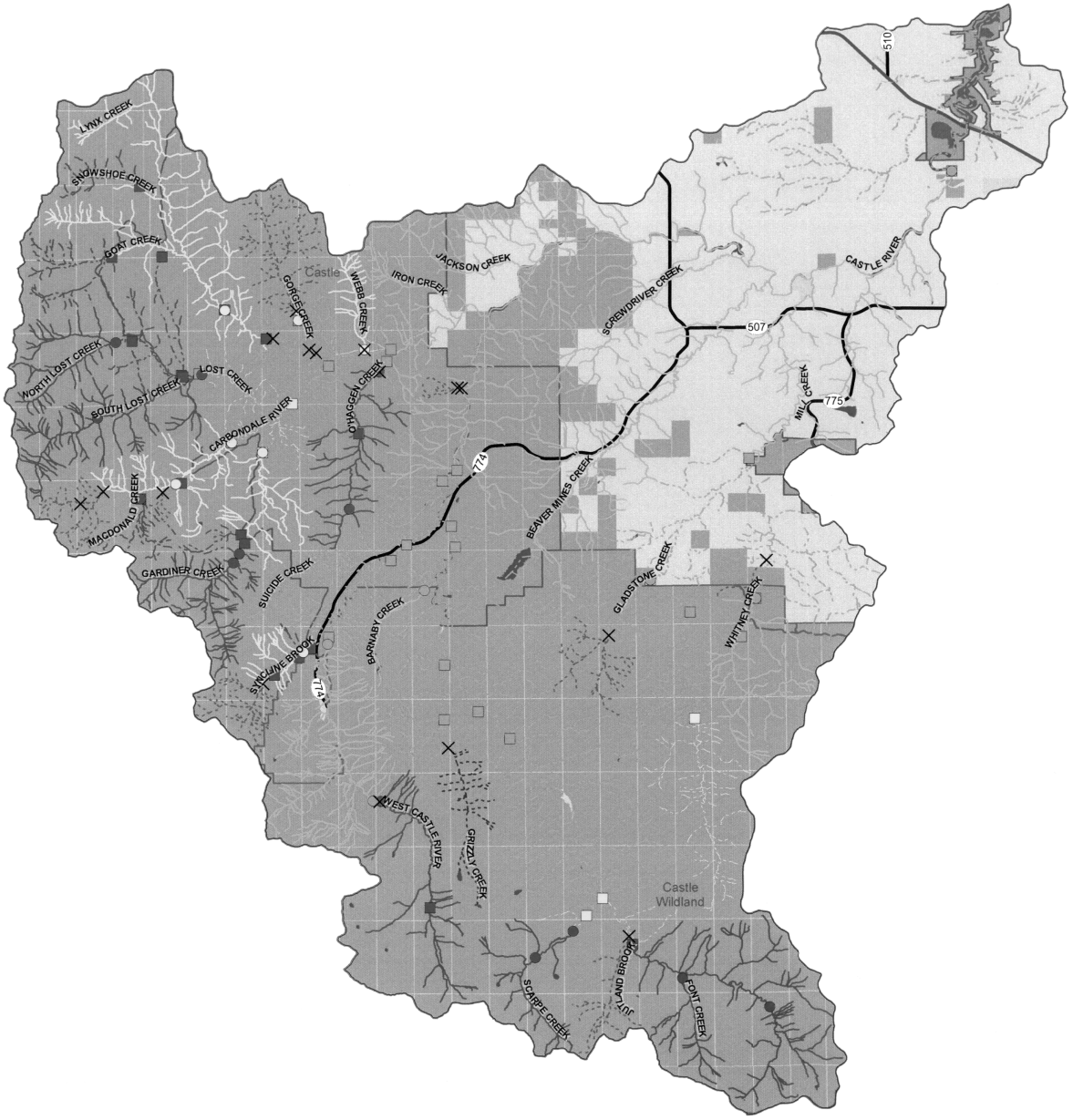
Westslope Cutthroat Trout

CASTLE RIVER

HUC 8: 04010103

Map Date: January 10, 2019

0 1.5 3 6 9 12 15 Kilometers



Genetic Sampling Sites

SNP Tested	Microsatellite Tested
Pure	Pure
Near Pure	Near Pure
Hybrid	Hybrid

Land Ownership

- Federal
- Municipal
- Private
- Provincial

Genetic Purity

- Pure - High Confidence
- Pure - Low Confidence
- Near Pure - High Confidence
- Near Pure - Low Confidence
- Hybrid - High Confidence
- Hybrid - Low Confidence
- Above barrier - no WSCT documented
- Above barrier - no fish documented

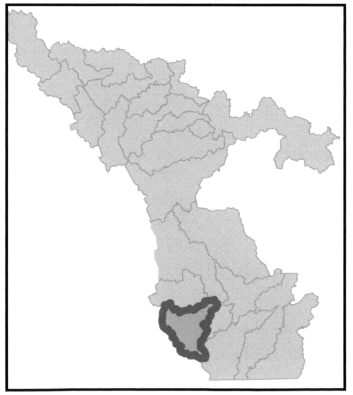
Note: Barriers and genetic sample sites are current to map date at best and are subject to change as new information becomes available.

- HUC 8
- Permanent barrier to upstream fish movement
- National Parks
- Provincial Parks and Protected Areas
- Primary Highways
- Secondary Highways

DRAFT - NOT FOR DISTRIBUTION

Prepared by EP, Blairmore, South Saskatchewan Region - January 2019

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.



N

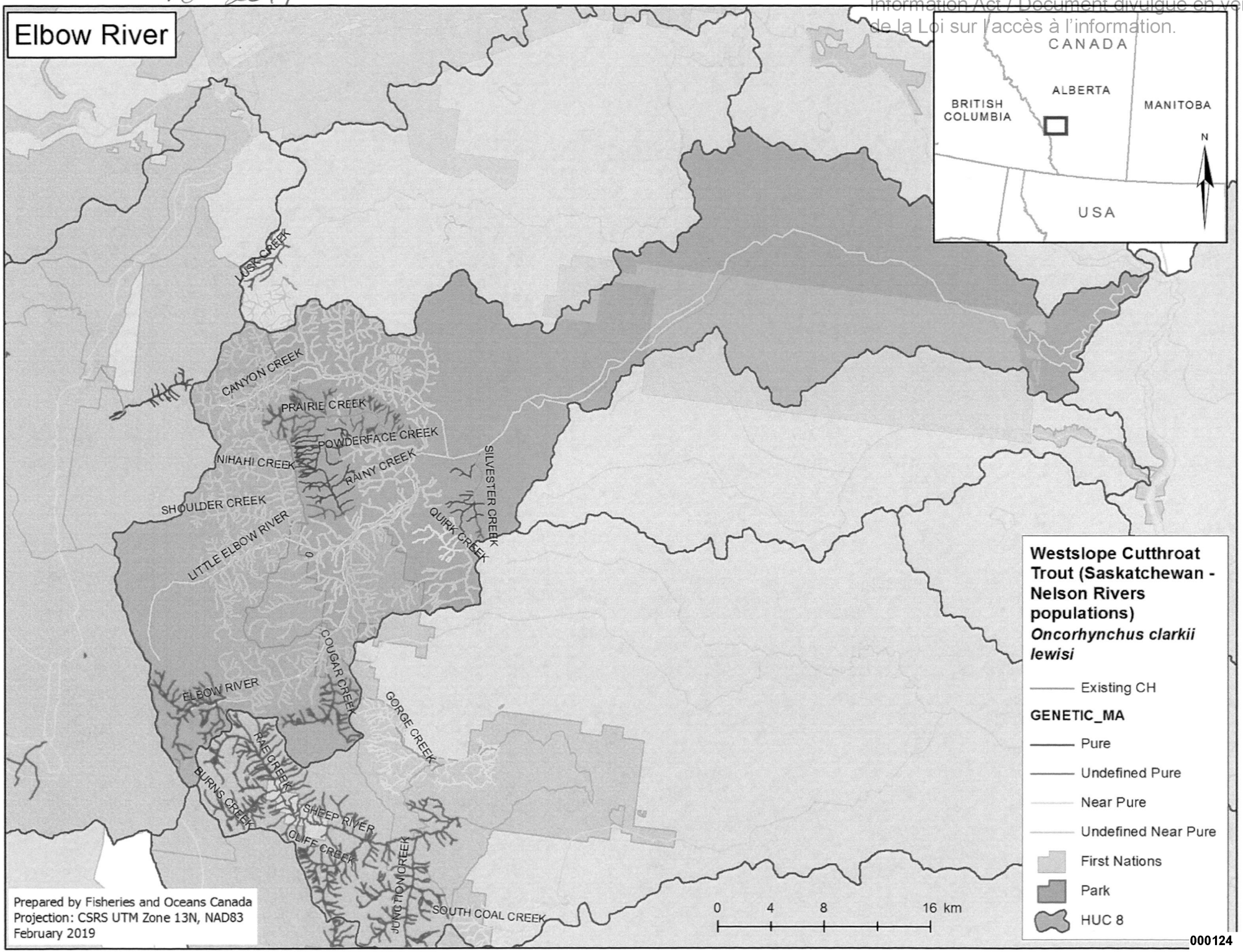
Data Frame: NAD 1983
10TM AEP Forest

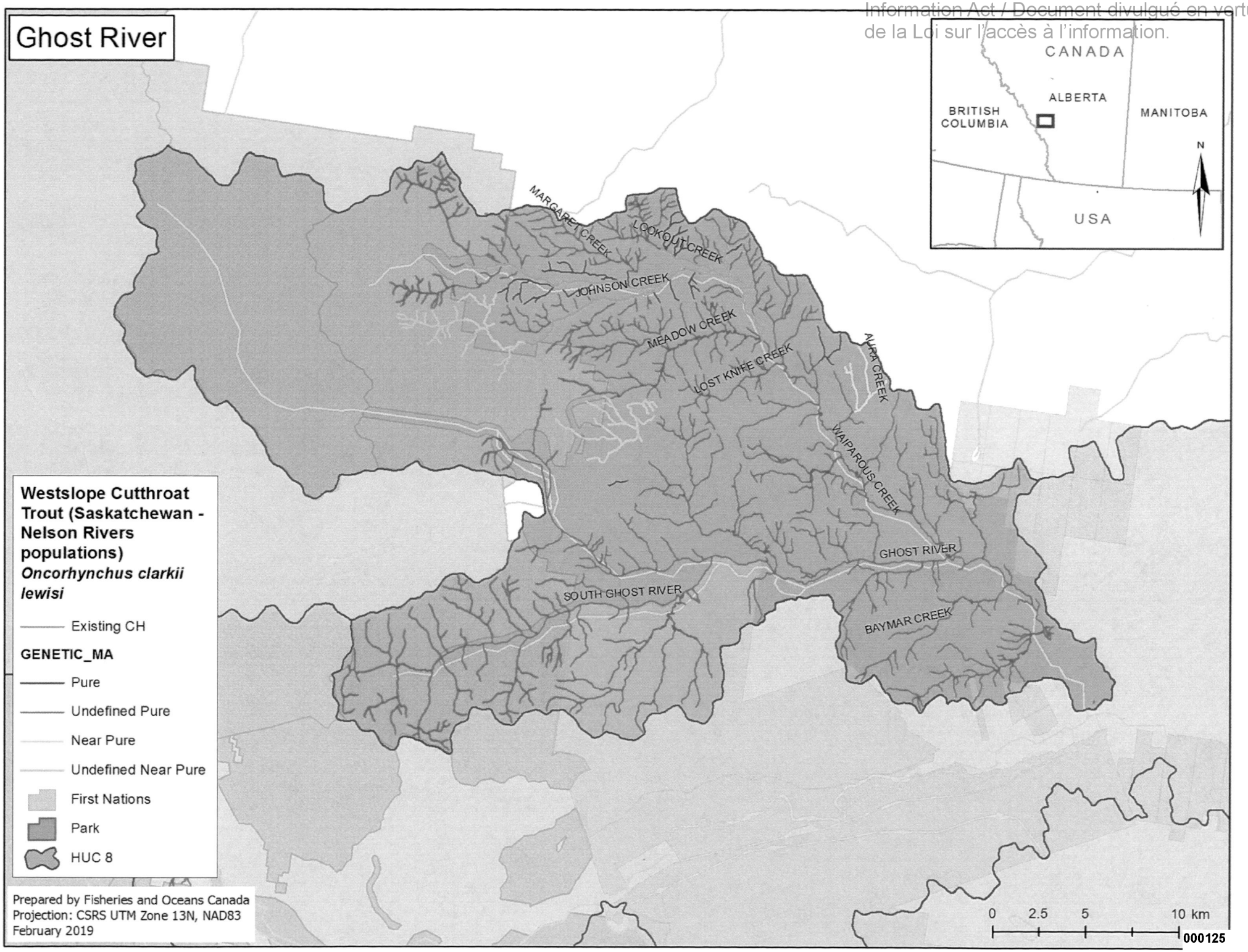
Alberta Government

000123

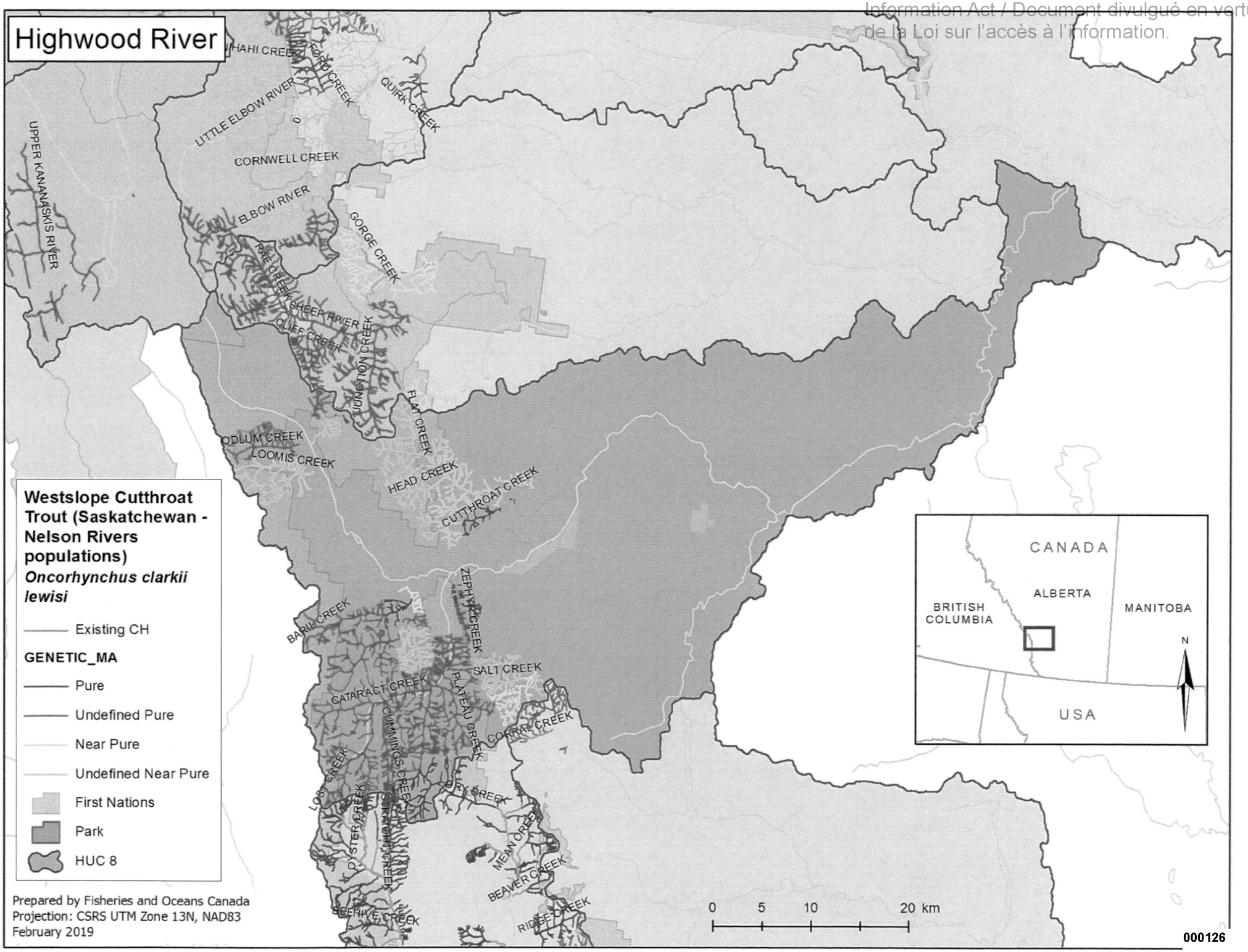
Project: \\env.gov.ab.ca\GIS\RegGIS\Blairmore\Workspace\FishAndWildlife\WSCT_genetic_barrier_FMO_mapping\Documents\Maps\2018_GDP_Update_PrintTemplate

2-18-2019

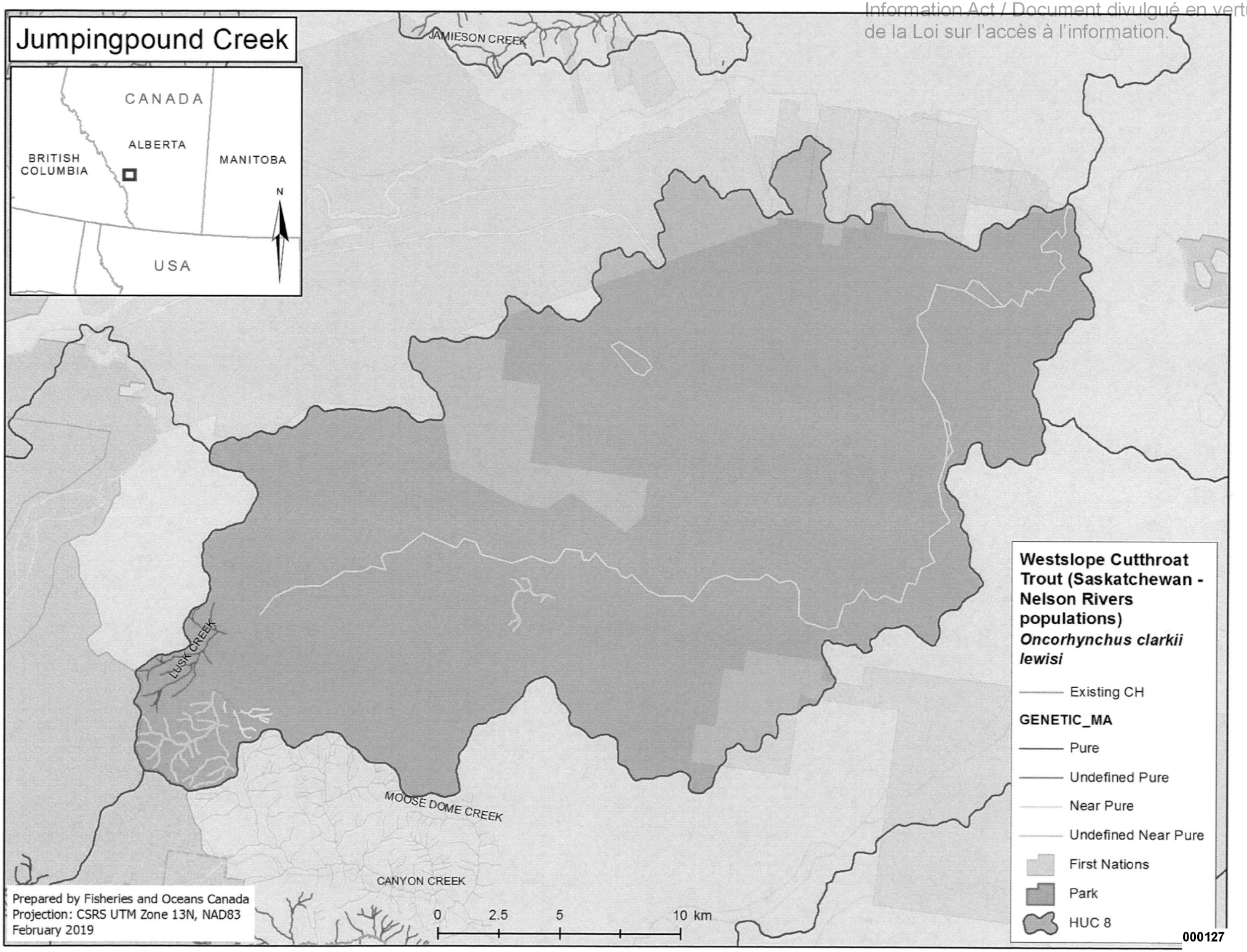


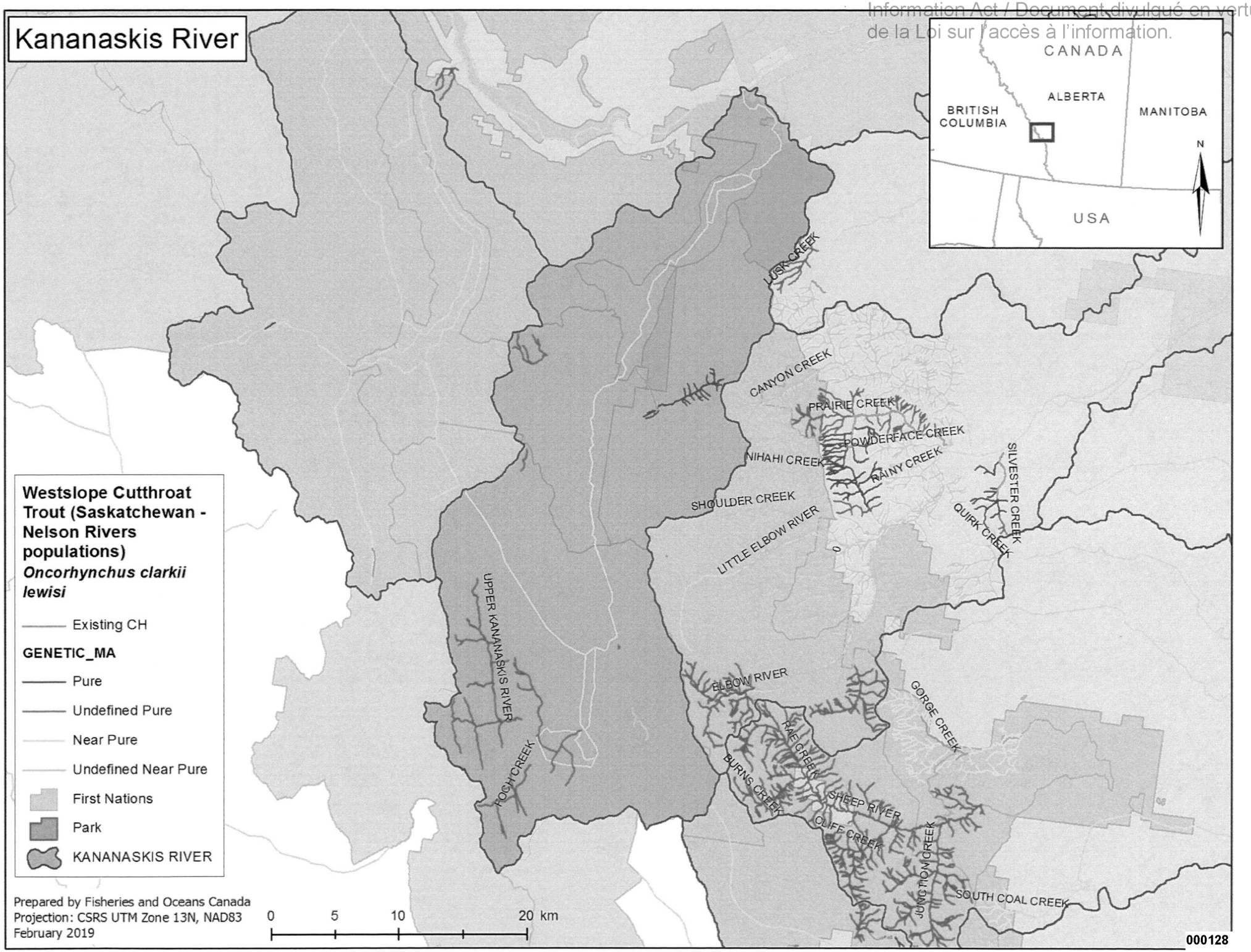


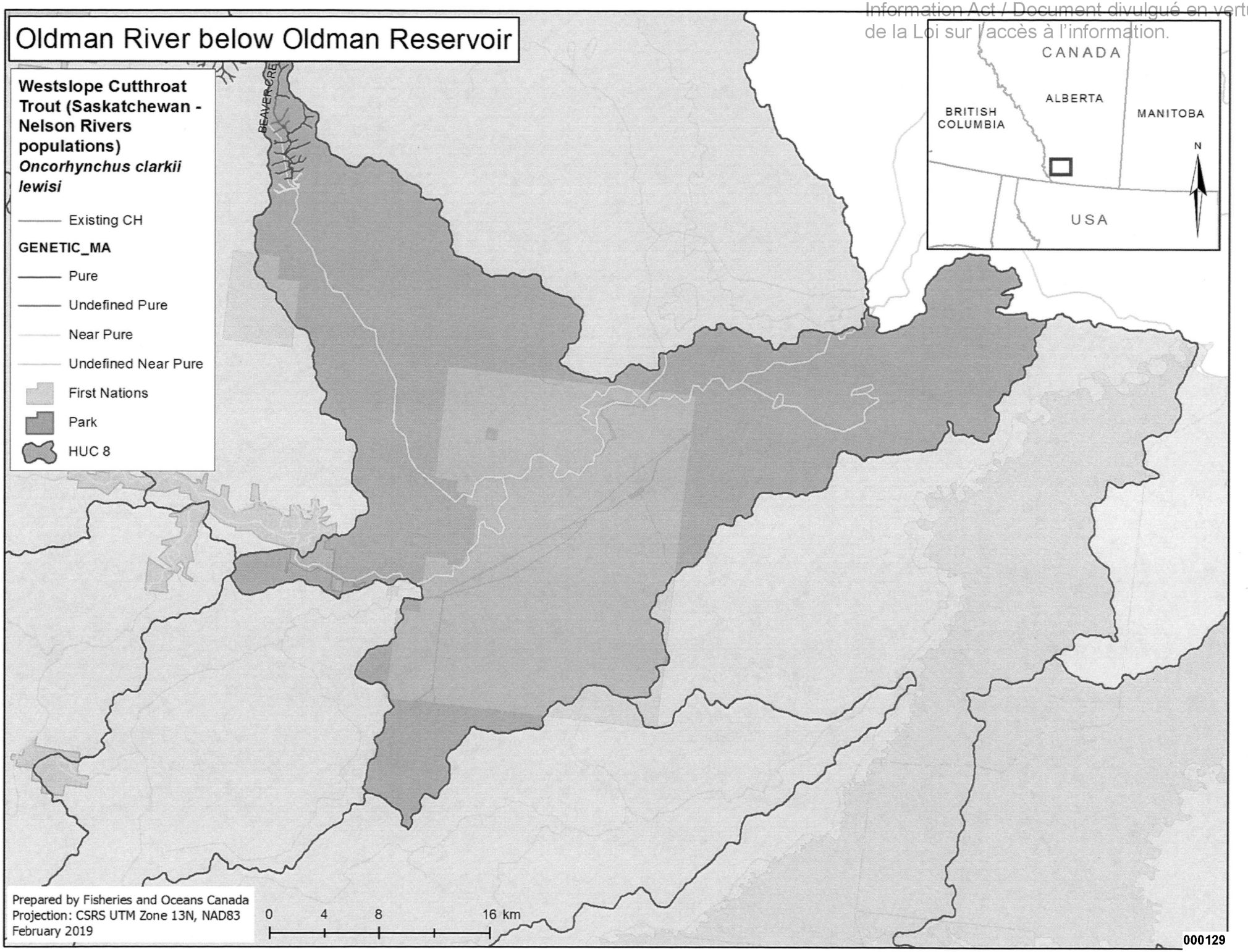
000125

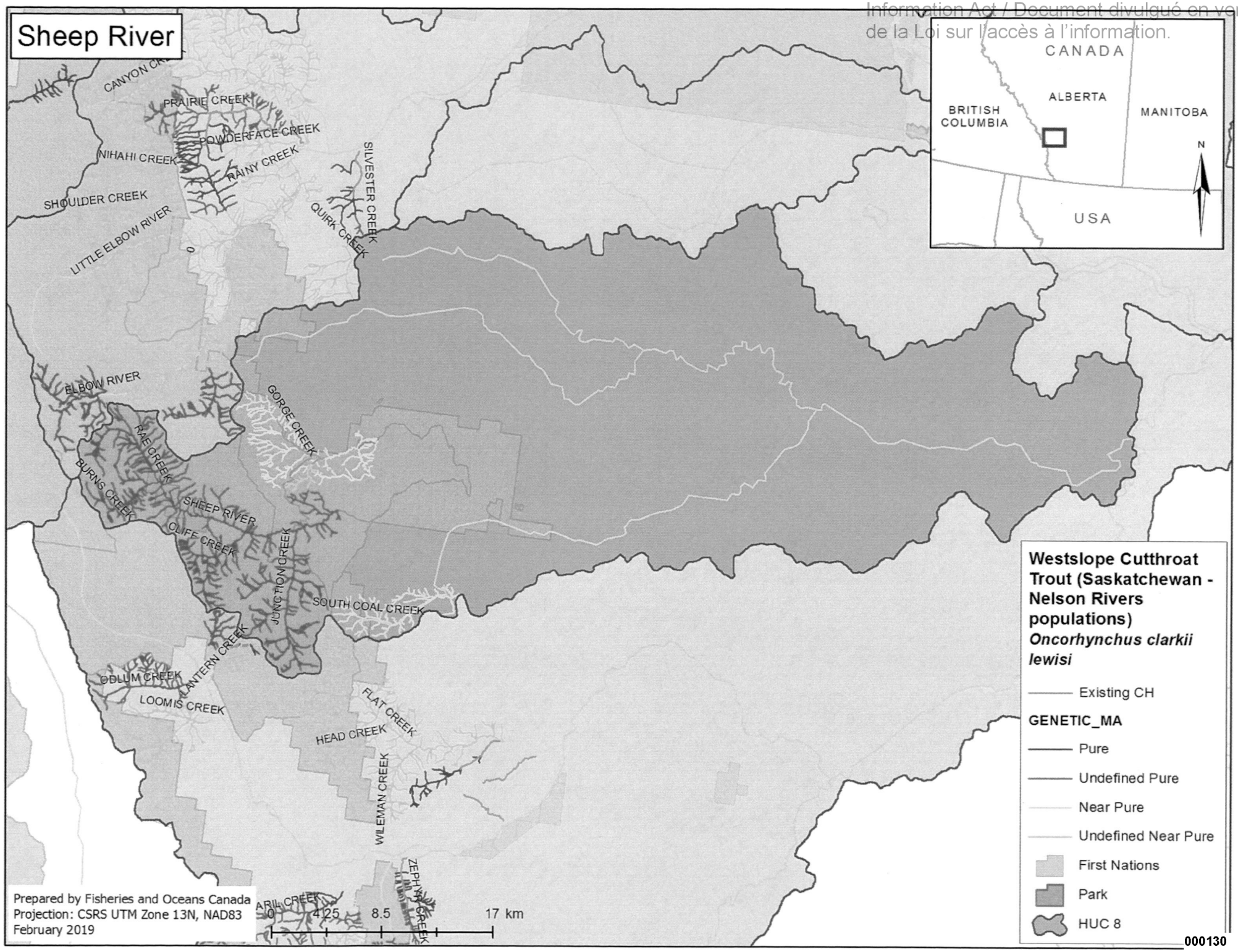


000126









000130

Upper Oldman River

Westslope Cutthroat Trout (Saskatchewan - Nelson Rivers populations)
Oncorhynchus clarkii lewisi

Existing CH

GENETIC_MA

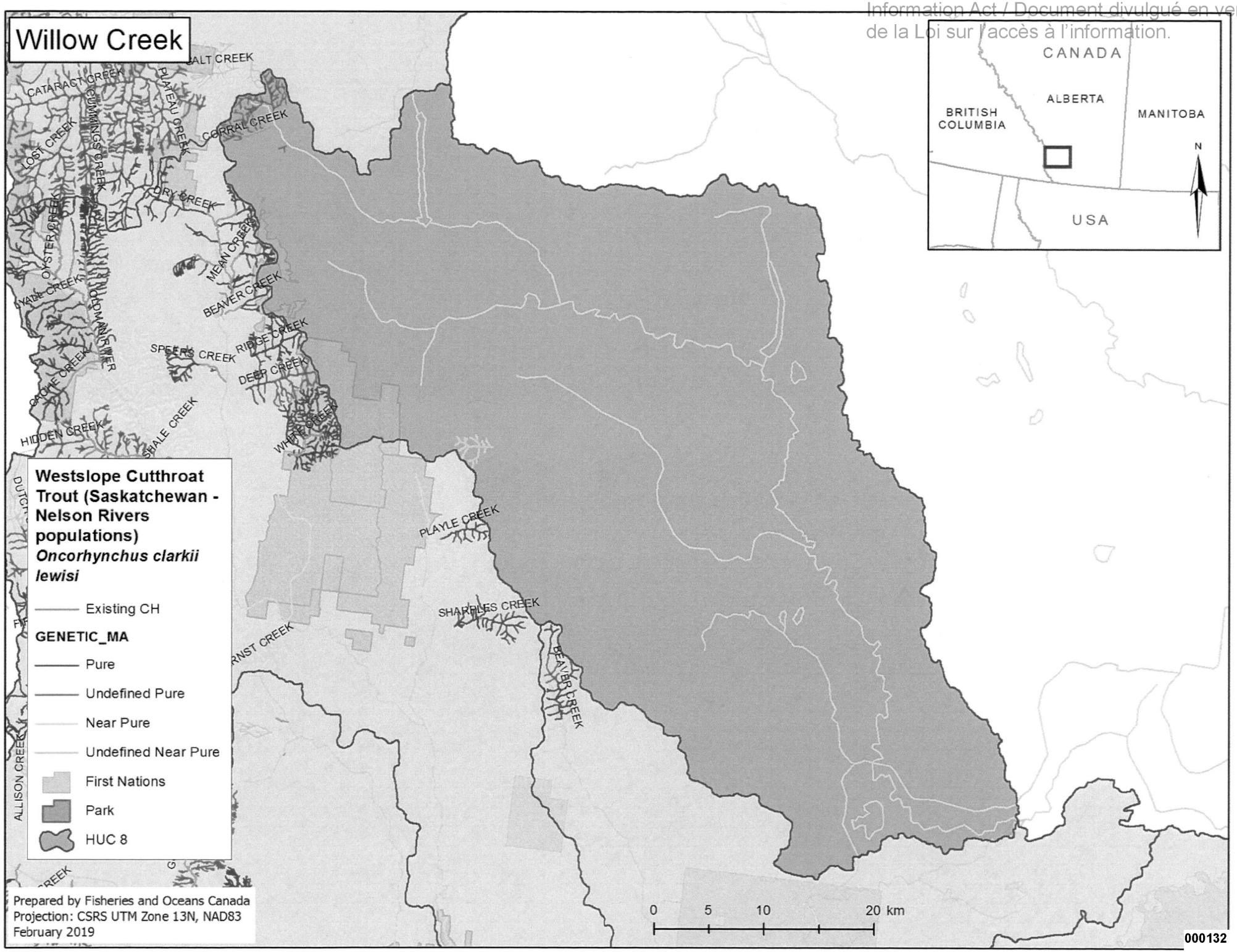
- Pure
- Undefined Pure
- Near Pure
- Undefined Near Pure
- First Nations
- Park
- HUC 8

CATARACT CREEK
PLATEAU CREEK
CORRAL CREEK
LOST CREEK
CUMMINGS CREEK
DRY CREEK
OYSTER CREEK
PASQUE CREEK
OLDMAN RIVER
MEAN CREEK
BEAVER CREEK
SPEERS CREEK
DEEP CREEK
CACHE CREEK
HIDDEN CREEK
SHALE CREEK
WHITE CREEK
DUTCH CREEK
PLAYLE CREEK
FIRST CREEK
SHARPLES CREEK
RACEHORSE CREEK
ERNST CREEK
SOUTH
DAISY CREEK
ALLISON CREEK
GOLD CREEK
STAR CREEK
NORTH YORK CREEK
LYNX CREEK
GOAT CREEK

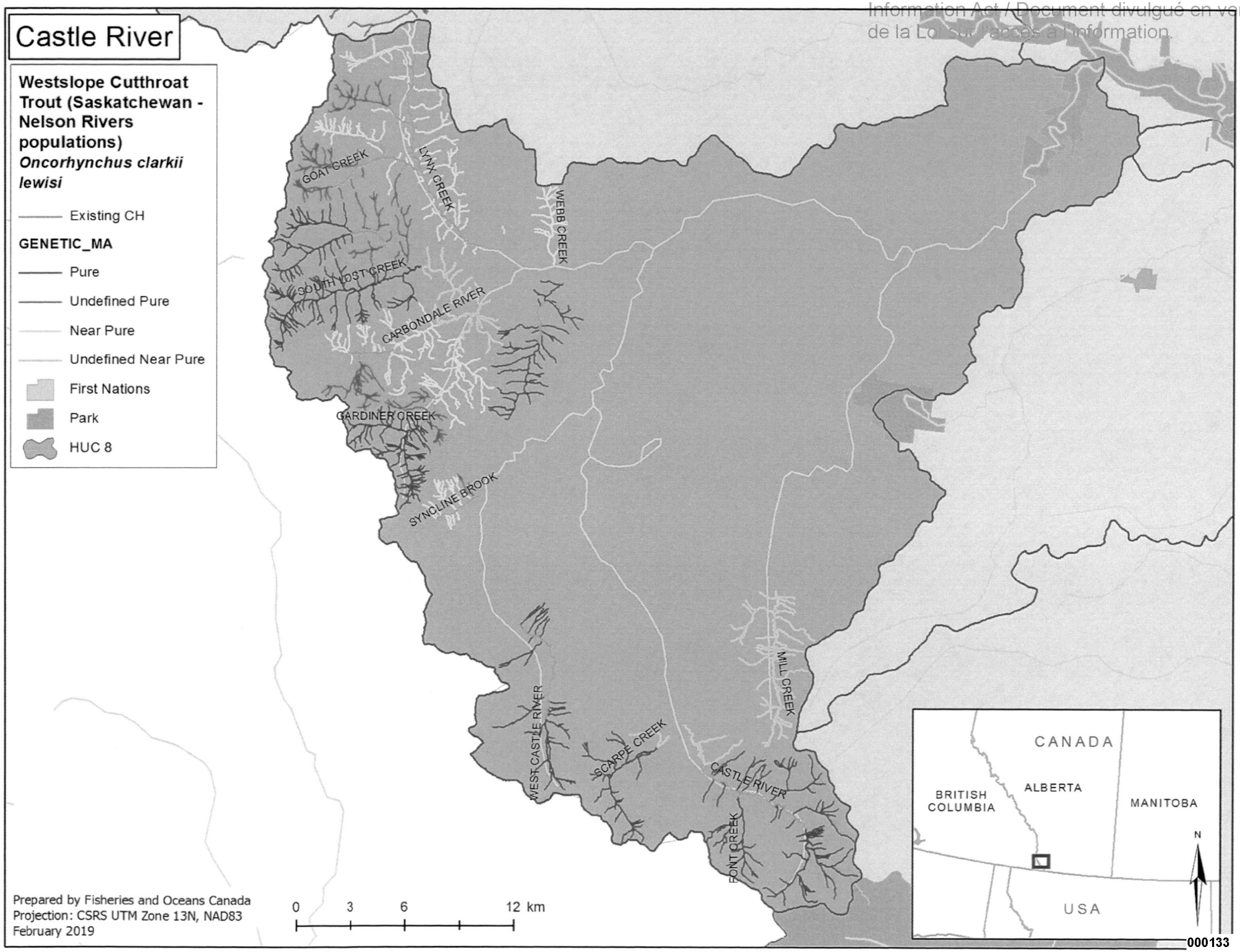
0 5 10 20 km

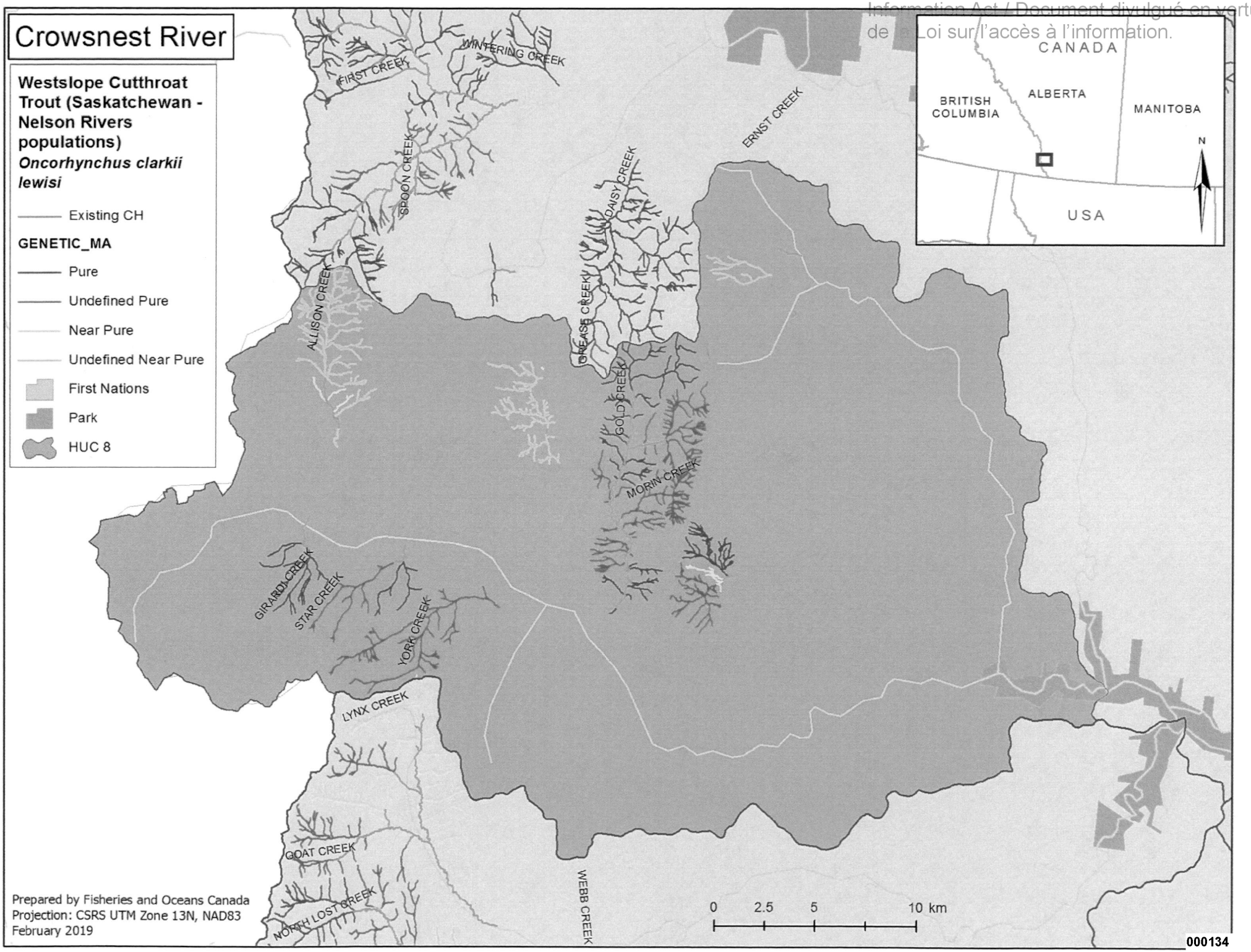
Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

000131



000132





000134

Lacho, Christine

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 3:17 PM
To: Doolittle, Andrew
Cc: Gillespie, Ashley
Subject: GHOST RIVER and ELBOW RIVER (2 options)
Attachments: Ghost River ERNIE Feb 19 OPTION 1.jpg; Elbow River ERNIE Feb 19.jpg; Ghost River ERNIE Feb 19 OPTION 2.jpg

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 1:12 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: CASTLE and CROWSNEST

Thanks Andrew! I have put notes right in the map.

If you have questions, please call me on my mobile [redacted]

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 12:46 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi all – just wondering how your review is going?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-18-19 10:42 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

[redacted]

To meet our timelines to post to the registry prior to the house rising for the summer, we must ensure that Alberta Environment and Parks supports our approach before the document is sent for review: we want to provide them a draft product for endorsement...hopefully by tomorrow evening.

Andrew G. has talked to Andrew D. about the approach to the exercise he did today, and where he has stored the files he has been working from. I copied you on an example of draft products that were produced and continue to modify. I will be working with Ashley tomorrow morning to complete the rest of the maps, and will likely be asking Andrew his assistance in excising the identified reaches from the maps in the afternoon.

We will continue to produce better drafts over the next couple days, and we will fully engage you Thursday to work on refining them.

As always, we truly appreciate the support you and Andrew provide us.

Ernie

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 5:50 PM
To: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi Ernie – given the sensitivity of this species I think it would be good to give us a bit more time to get the maps made. I'll be back in the office on Thursday and can work on it then.

I hope you all agree and give us at least another day to meet your timelines.
Carolyn

From: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 7:10 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Ernie, I am away tuesday-wednesday this week, and we do **not** have Monday (family day) off. I am only available today to work on this task. This mapping work has been ongoing between Ashley and Carolyn, and they did a significant amount of GIS work regarding the critical habitat. It sounds based on your description that the plan is to abandon the previous mapping work that was done and to use data that has been provided by the province of Alberta instead, is that correct? Who will be providing direction on the mapping specifics, with Ashley away today? We need information regarding how many areas need to be mapped and their extent as soon as possible. Please call me immediately.

From: Watson, Ernest
Sent: February 17, 2019 9:15 PM

To: Geraghty, Andrew; Doolittle, Andrew
Cc: Gillespie, Ashley; Bakelaar, Carolyn; Curtis, Martyn
Subject: FW: HEADS UP: Westslope Cutthroat Trout Mapping!

Andrew and Andrew:

With Carolyn away, we will be relying on you to help out with producing the maps we require, which must be done by Thursday morning if we are going to be able to keep to our timelines. I will send you both a calendar invite for a call for first thing Tuesday morning to go over requirements.

Ernie.

From: Watson, Ernest
Sent: Sunday, February 17, 2019 6:04 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Mapping!
Importance: High

Hello Carolyn / Andrew:

I think Ashley has already done so, but want to give you the warning that Martyn received the shape files for the genetic distributions for Westslope on Friday and will be attempting to upload them tonight.

Ashley is back on Tuesday, and we intend to finalize final distribution of WSCT Critical Habitat as soon as we can...we have a very ambitious schedule to get the draft RS/AP together for review. Your support is essential and greatly appreciated!

Thanks, Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

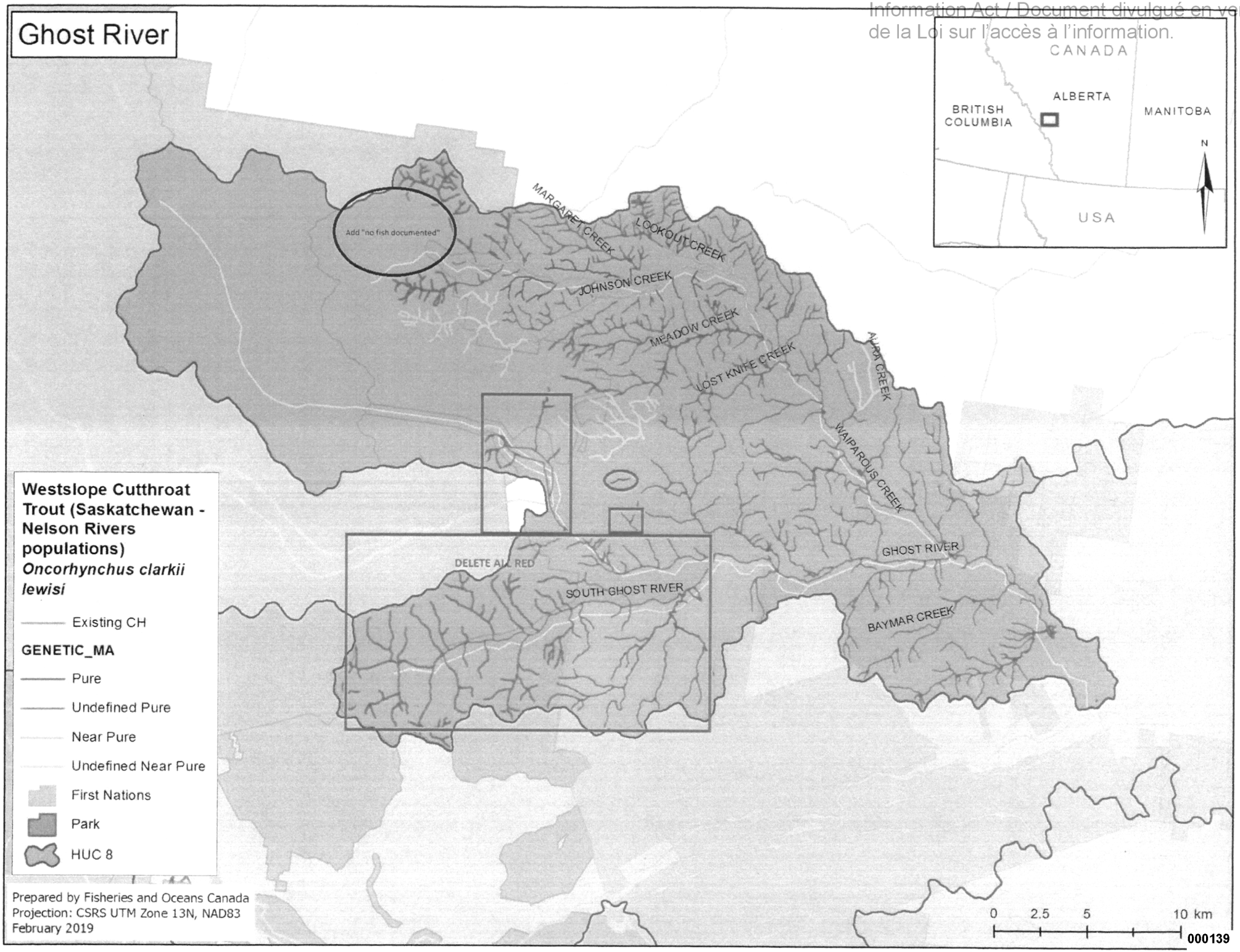
Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

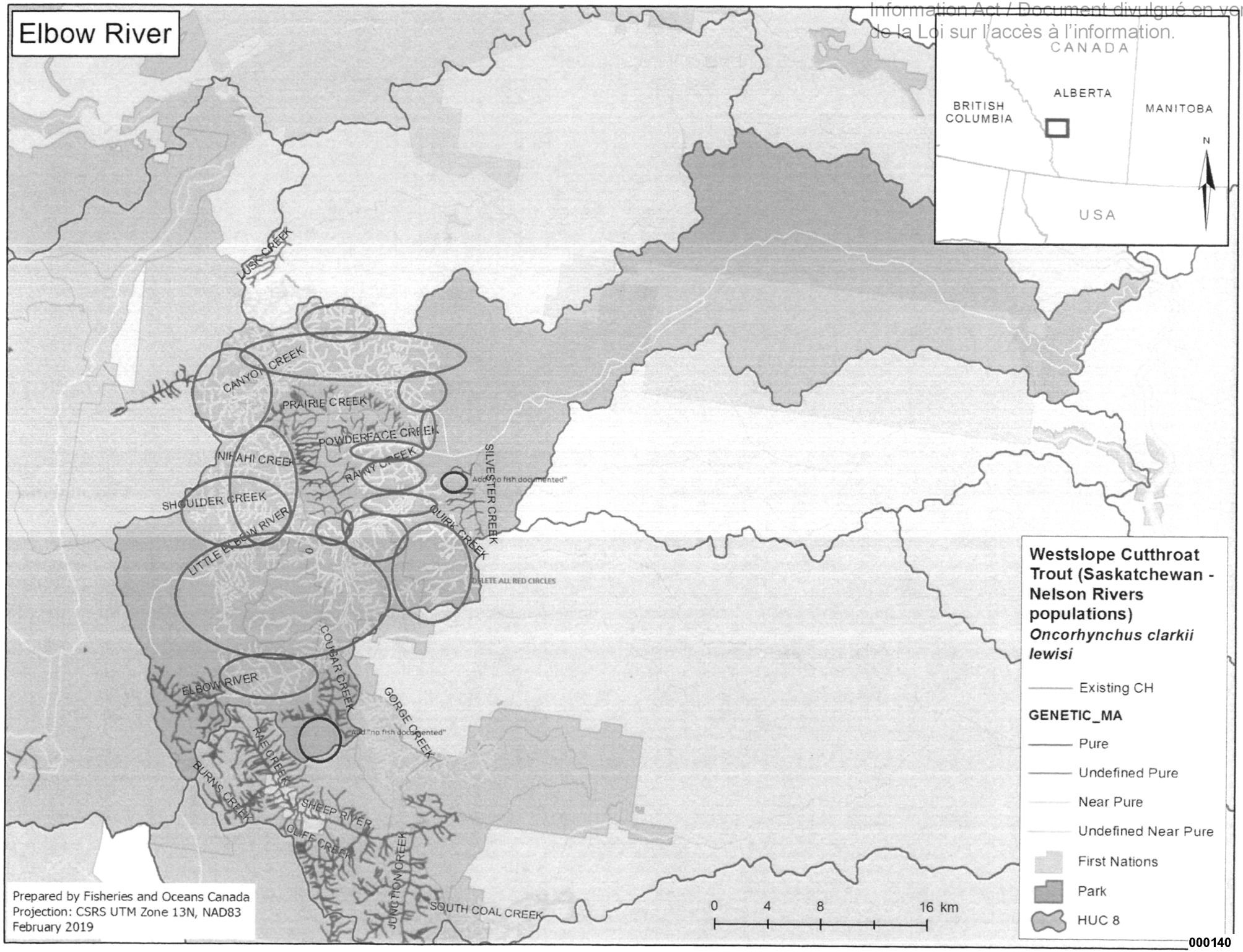
Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611





Ghost River

Add "no fish documented"

MARGARET CREEK
LOOKOUT CREEK
JOHNSON CREEK
MEADOW CREEK
LOST KNIFE CREEK
ALTA CREEK
WAIPAROUS CREEK
GHOST RIVER
SOUTH GHOST RIVER
BAYMAR CREEK
DELETE ALL RED

Westslope Cutthroat Trout (Saskatchewan - Nelson Rivers populations)
Oncorhynchus clarkii lewisi

- Existing CH

GENETIC_MA

- Pure
- Undefined Pure
- Near Pure
- Undefined Near Pure
- First Nations
- Park
- HUC 8

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

0 2.5 5 10 km

000141

s.19(1)

Lacho, Christine

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 4:29 PM
To: Doolittle, Andrew
Cc: Gillespie, Ashley
Subject: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW
Attachments: Upper Oldman River ERNIE Feb 19.jpg; Willow Creek ERNIE Feb 19.jpg; Highwood River ERNIE FEB 19.jpg; Jumpingpound Creek ERNIE Feb 19.jpg; Kananaskis River ERNIE Feb 19.jpg; Oldman below Oldman Reservoir ERNIE Feb 19.jpg; Sheep River ERNIE Feb 19.jpg

The rest...

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 3:17 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: GHOST RIVER and ELBOW RIVER (2 options)

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 1:12 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: CASTLE and CROWSNEST

Thanks Andrew! I have put notes right in the map.

If you have questions, please call me on my mobile

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 12:46 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi all – just wondering how your review is going?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-18-19 10:42 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

To meet our timelines to post to the registry prior to the house rising for the summer, we must ensure that Alberta Environment and Parks supports our approach before the document is sent for review: we want to provide them a draft product for endorsement...hopefully by tomorrow evening.

Andrew G. has talked to Andrew D. about the approach to the exercise he did today, and where he has stored the files he has been working from. I copied you on an example of draft products that were produced and continue to modify. I will be working with Ashley tomorrow morning to complete the rest of the maps, and will likely be asking Andrew his assistance in excising the identified reaches from the maps in the afternoon.

We will continue to produce better drafts over the next couple days, and we will fully engage you Thursday to work on refining them.

As always, we truly appreciate the support you and Andrew provide us.

Ernie

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 5:50 PM
To: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi Ernie – given the sensitivity of this species I think it would be good to give us a bit more time to get the maps made. I'll be back in the office on Thursday and can work on it then.

I hope you all agree and give us at least another day to meet your timelines.
Carolyn

From: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 7:10 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Ernie, I am away tuesday-wednesday this week, and we do **not** have Monday (family day) off. I am only available today to work on this task. This mapping work has been ongoing between Ashley and Carolyn, and they did a significant amount of GIS work regarding the critical habitat. It sounds based on your description that the plan is to abandon the previous mapping work that was done and to use data that has been provided by the province of Alberta instead, is that correct? Who will be providing direction on the mapping specifics, with Ashley away today? We need information regarding how many areas need to be mapped and their extent as soon as possible. Please call me immediately.

From: Watson, Ernest
Sent: February 17, 2019 9:15 PM
To: Geraghty, Andrew; Doolittle, Andrew
Cc: Gillespie, Ashley; Bakelaar, Carolyn; Curtis, Martyn
Subject: FW: HEADS UP: Westslope Cutthroat Trout Mapping!

Andrew and Andrew:

With Carolyn away, we will be relying on you to help out with producing the maps we require, which must be done by Thursday morning if we are going to be able to keep to our timelines. I will send you both a calendar invite for a call for first thing Tuesday morning to go over requirements.

Ernie.

From: Watson, Ernest
Sent: Sunday, February 17, 2019 6:04 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Mapping!
Importance: High

Hello Carolyn / Andrew:

I think Ashley has already done so, but want to give you the warning that Martyn received the shape files for the genetic distributions for Westslope on Friday and will be attempting to upload them tonight.

Ashley is back on Tuesday, and we intend to finalize final distribution of WSCT Critical Habitat as soon as we can...we have a very ambitious schedule to get the draft RS/AP together for review. Your support is essential and greatly appreciated!

Thanks, Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron

<Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.
Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Page 147

is a duplicate of

est un duplicata de la

page 222

Page 148

is a duplicate of

est un duplicata de la

page 230

Page 149
is a duplicate of
est un duplicata de la
page 223

Pages 150 to / à 151
are duplicates of
sont des duplicatas des
pages 227 to / à 228

Page 152
is a duplicate of
est un duplicata de la
page 231

Page 153
is a duplicate of
est un duplicata de la
page 221

Lacho, Christine

From: Gillespie, Ashley
Sent: Tuesday, February 19, 2019 2:42 PM
To: Watson, Ernest
Subject: Notes
Attachments: Mapping Notes w Decisions Feb 19.onepkg

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 1:12 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: CASTLE and CROWSNEST

Thanks Andrew! I have put notes right in the map.

If you have questions, please call me on my mobile

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 12:46 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi all – just wondering how your review is going?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-18-19 10:42 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

To meet our timelines to post to the registry prior to the house rising for the summer, we must ensure that Alberta Environment and Parks supports our approach before the document is sent for review: we want to provide them a draft product for endorsement...hopefully by tomorrow evening.

Andrew G. has talked to Andrew D. about the approach to the exercise he did today, and where he has stored the files he has been working from. I copied you on an example of draft products that were produced and continue to modify. I will be working with Ashley tomorrow morning to complete the rest of the maps, and will likely be asking Andrew his assistance in excising the identified reaches from the maps in the afternoon.

We will continue to produce better drafts over the next couple days, and we will fully engage you Thursday to work on refining them.

s.19(1)

As always, we truly appreciate the support you and Andrew provide us.

Ernie

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 5:50 PM
To: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi Ernie – given the sensitivity of this species I think it would be good to give us a bit more time to get the maps made. I'll be back in the office on Thursday and can work on it then.

I hope you all agree and give us at least another day to meet your timelines.
Carolyn

From: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 7:10 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Ernie, I am away tuesday-wednesday this week, and we do **not** have Monday (family day) off. I am only available today to work on this task. This mapping work has been ongoing between Ashley and Carolyn, and they did a significant amount of GIS work regarding the critical habitat. It sounds based on your description that the plan is to abandon the previous mapping work that was done and to use data that has been provided by the province of Alberta instead, is that correct? Who will be providing direction on the mapping specifics, with Ashley away today? We need information regarding how many areas need to be mapped and their extent as soon as possible. Please call me immediately.

From: Watson, Ernest
Sent: February 17, 2019 9:15 PM
To: Geraghty, Andrew; Doolittle, Andrew
Cc: Gillespie, Ashley; Bakelaar, Carolyn; Curtis, Martyn
Subject: FW: HEADS UP: Westslope Cutthroat Trout Mapping!

Andrew and Andrew:

With Carolyn away, we will be relying on you to help out with producing the maps we require, which must be done by Thursday morning if we are going to be able to keep to our timelines. I will send you both a calendar invite for a call for first thing Tuesday morning to go over requirements.

Ernie.

From: Watson, Ernest
Sent: Sunday, February 17, 2019 6:04 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Mapping!
Importance: High

Hello Carolyn / Andrew:

I think Ashley has already done so, but want to give you the warning that Martyn received the shape files for the genetic distributions for Westslope on Friday and will be attempting to upload them tonight.

Ashley is back on Tuesday, and we intend to finalize final distribution of WSCT Critical Habitat as soon as we can...we have a very ambitious schedule to get the draft RS/AP together for review. Your support is essential and greatly appreciated!

Thanks, Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan,

that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Lacho, Christine

From:	Curtis, Martyn
Sent:	Wednesday, February 20, 2019 12:07 AM
To:	Craig Johnson; Sue Cotterill; Rob Simieritsch
Cc:	Watson, Ernest; Hoggarth, Thomas
Subject:	Re: Heads up and request re WSCT RS/AP nee CH

Looks like were going to need until tomorrow around noon to finalize the maps. I will be in touch in the morning.

Have a good evening

M

Martyn Curtis

Director, Fish and Fish Habitat Protection & Species at Risk
Fisheries and Oceans Canada
Government of Canada

Tel | Tél: (204) 983-4223
Email | Courriel: Martyn.Curtis@dfo-mpo.gc.ca

-------- Original message --------
From: "Curtis, Martyn" <Martyn.Curtis@dfo-mpo.gc.ca>
Date: 2019-02-18 20:21 (GMT-06:00)
To: Craig Johnson <Craig.Johnson@gov.ab.ca>, Sue Cotterill <Sue.Cotterill@gov.ab.ca>, Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Cc: "'Watson, Ernest'" <Ernest.Watson@dfo-mpo.gc.ca>, "Hoggarth, Thomas (Thomas.Hoggarth@dfo-mpo.gc.ca)" <Thomas.Hoggarth@dfo-mpo.gc.ca>
Subject: RE: Heads up and request re WSCT RS/AP nee CH

Thanks Craig *et al.* we will have the criteria we used articulated along with the maps showing which categories were included all in one package for your team.

The new areas beyond the discussions from Friday include: the near pure (high confidence) locations (Near pure = 0.985 - 0.955) adjacent to pure/know CH locations. These were added factoring in the precautionary principle in addition to the purity data and adjacency to existing pure locations. We feel this is inline with AB recommendation and is both reasonable and defensible. Near pure locations not adjacent to existing pure CH were not included (at this time).

We will be finishing up the maps tomorrow, I will have Ashley and Ernie confirm on our end and get them to you and you're team ASAP (before midnight) assuming nothing goes sideways tomorrow.

Thanks again

Until tomorrow

M

Martyn Curtis

Director, Fish and Fish Habitat Protection & Species at Risk
Fisheries and Oceans Canada
Central and Arctic Region
Government of Canada

Tel | Tél: (204) 983-4223
Fax | Téléc: (204) 983-7983
Email | Courriel: Martyn.Curtis@dfo-mpo.gc.ca

-----Original Message-----
From: Craig Johnson <Craig.Johnson@gov.ab.ca>
Sent: Monday, February 18, 2019 8:24 PM
To: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Cc: Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Subject: Re: Heads up and request re WSCT RS/AP nee CH

Thanks Martyn,

I and my team will review these maps tomorrow and provide comments. It will help if your team can clarify the scope of review required to ensure that we are efficient.

The purity levels we use are:
Pure = >0.985 (I'm sure we round these up) Near pure = 0.985 - 0.955 Hybridized = < or equal to 0.95

I'll confirm these categories with the team. Our near pure category is broader than what you suggested below but is still likely defensible to include, especially if it is adjacent to existing CH.

We'll be talking tomorrow I'm sure...cheers...Craig

> On Feb 18, 2019, at 3:48 PM, Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca> wrote:
>
>
> Hello from Ottawa, just wanted to give you an advanced heads up I am
> hoping to send you and email containing the new maps for addtional CH
> tomorrow before midnight. Hoping to get you're review and also hoping
> we can get a written response of concurance and support from AEP
> senior management (TR)
>
> After seeing the maps as they were being developed I have changed my
> position for the near pure high confidence locations that are adjacent
> to existing CH. Friday I had stated we wouldn't be touching near pure
> at this time linking to COSEWIC pureity levels. Applying the
> precautionary approach based on the proximity to existing pure
> locations will lead to more scientifically defensable CH this round

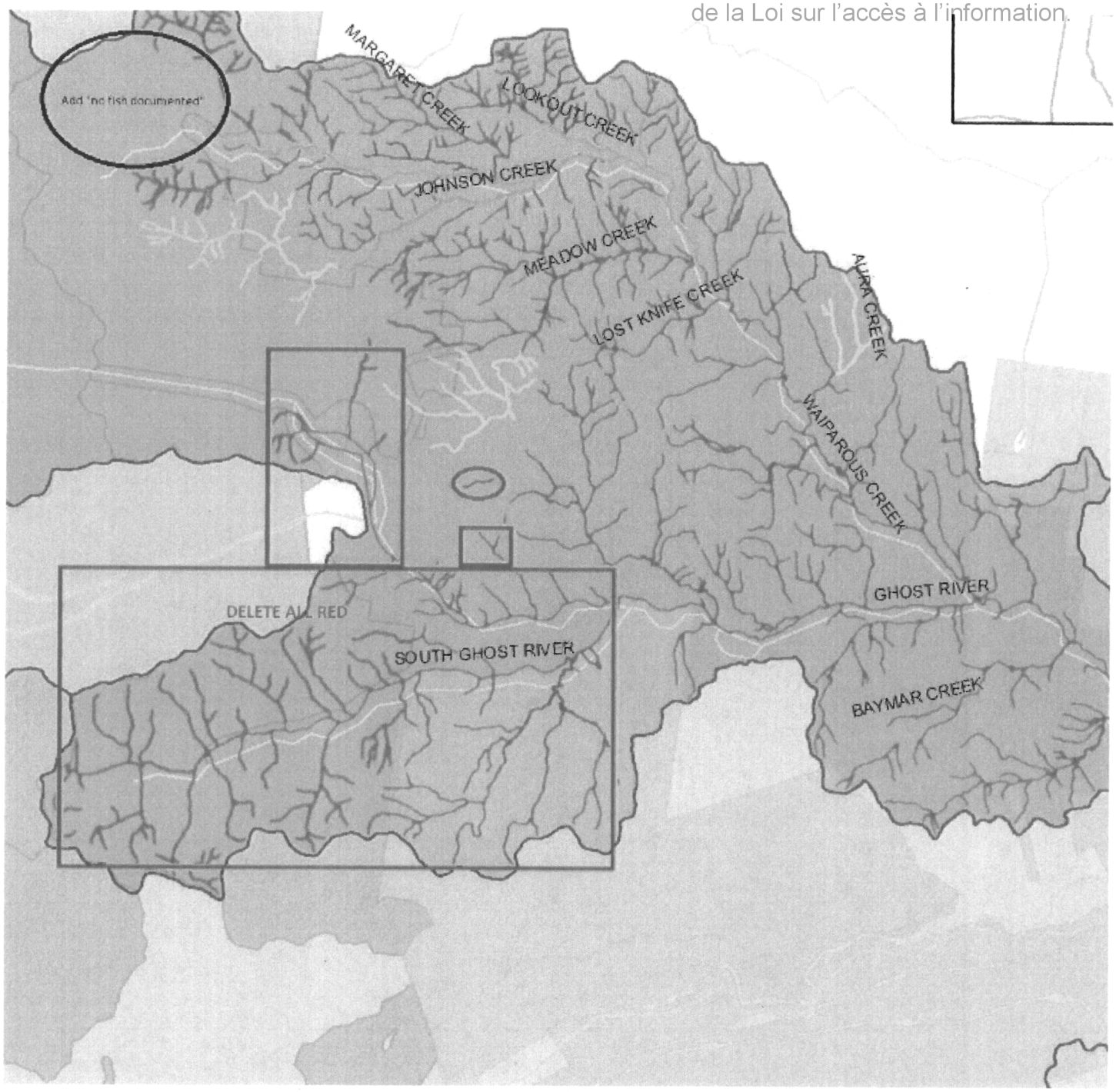
> (need to confirm near pure is at the 0.985 -0.99 purity level)
>
> More to come, hope you're enjoying Family Day!
>
> Talk soon
>
> M
>
>
> Martyn Curtis
>
> Director, Fish and Fish Habitat Protection & Species at Risk Fisheries
> and Oceans Canada Government of Canada
>
> Tel | Tél: (204) 983-4223
> Email | Courriel: Martyn.Curtis@dfo-mpo.gc.ca

Lacho, Christine

From: Doolittle, Andrew
Sent: Wednesday, February 20, 2019 8:41 AM
To: Gillespie, Ashley
Cc: Watson, Ernest
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Also, in Scenario 1 for the Ghost River – there is one small segment of Undefined Pure (not easily seen) on the map. Did you want me to do anything with that? (leave it as-is? add streams around it? or remove like the South Ghost River?)

Thanks



From: Doolittle, Andrew
Sent: February-20-19 9:34 AM
To: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Cc: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Ok great thanks! So regardless of what is in the GIS layer (in the attributes) for those streams that we added, it will have the same legend heading of "Above barrier – no fish documented"?

From: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Sent: February-20-19 9:29 AM

To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Hi Andrew,

I'm not sure if Ernie replied yet but I can help with the questions.

1. Remove the CH as well for the segments that were circled.
2. I'm not sure what the wording is in the template, but in the rule-set that Alberta provided they titled these segments as "Above barrier – no fish documented". We are submitting these maps to Alberta for review, so it would be helpful if we were consistent with the wording that they used. Along those lines, could you change "undefined pure" to "Pure – Low confidence" and "undefined Near Pure" to " Near Pure – Low Confidence", again to be consistent with the way Alberta has termed these categories.
3. These will still be maps for review.

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 8:12 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW
Importance: High

Thanks Ernie – the data has been updated, just a couple final questions before getting to the maps.

You requested:

1. Map with all categories in respective colours
2. FINAL map with proposed CH as green with existing (2014) CH in red (or something similar)

My Questions:

1. There are areas where you said to remove the streams – some of which have some existing CH ... I am assuming that you want me to remove the CH represented in those areas as well?
2. There are some examples where you said to add "no fish documented" segments – the wording is slightly different in the GIS layer, so hopefully I captured what you were thinking... I am assuming it was any stream segments that fill in the gaps in those areas?
3. Am I just using the template that Andrew G. put together or do you want me to make adjustments to the content of the map? Guess I am just wondering if these are still going to be maps for 'review', as opposed to 'published'. The quickest way to get this done by lunch is using the existing template.

Thanks,
Andrew

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-19-19 5:29 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

The rest...

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 3:17 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: GHOST RIVER and ELBOW RIVER (2 options)

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 1:12 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: CASTLE and CROWSNEST

Thanks Andrew! I have put notes right in the map.

If you have questions, please call me on my mobile

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 12:46 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi all – just wondering how your review is going?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-18-19 10:42 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

To meet our timelines to post to the registry prior to the house rising for the summer, we must ensure that Alberta Environment and Parks supports our approach before the document is sent for review: we want to provide them a draft product for endorsement...hopefully by tomorrow evening.

Andrew G. has talked to Andrew D. about the approach to the exercise he did today, and where he has stored the files he has been working from. I copied you on an example of draft products that were produced and continue to modify. I will be working with Ashley tomorrow morning to complete the rest of the maps, and will likely be asking Andrew his assistance in excising the identified reaches from the maps in the afternoon.

We will continue to produce better drafts over the next couple days, and we will fully engage you Thursday to work on refining them.

As always, we truly appreciate the support you and Andrew provide us.

Ernie

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 5:50 PM
To: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi Ernie – given the sensitivity of this species I think it would be good to give us a bit more time to get the maps made. I'll be back in the office on Thursday and can work on it then.

I hope you all agree and give us at least another day to meet your timelines.
Carolyn

From: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 7:10 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Ernie, I am away tuesday-wednesday this week, and we do **not** have Monday (family day) off. I am only available today to work on this task. This mapping work has been ongoing between Ashley and Carolyn, and they did a significant amount of GIS work regarding the critical habitat. It sounds based on your description that the plan is to abandon the previous mapping work that was done and to use data that has been provided by the province of Alberta instead, is that correct? Who will be providing direction on the mapping specifics, with Ashley away today? We need information regarding how many areas need to be mapped and their extent as soon as possible. Please call me immediately.

From: Watson, Ernest
Sent: February 17, 2019 9:15 PM
To: Geraghty, Andrew; Doolittle, Andrew
Cc: Gillespie, Ashley; Bakelaar, Carolyn; Curtis, Martyn
Subject: FW: HEADS UP: Westslope Cutthroat Trout Mapping!

Andrew and Andrew:

With Carolyn away, we will be relying on you to help out with producing the maps we require, which must be done by Thursday morning if we are going to be able to keep to our timelines. I will send you both a calendar invite for a call for first thing Tuesday morning to go over requirements.

Ernie.

From: Watson, Ernest
Sent: Sunday, February 17, 2019 6:04 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Mapping!
Importance: High

Hello Carolyn / Andrew:

I think Ashley has already done so, but want to give you the warning that Martyn received the shape files for the genetic distributions for Westslope on Friday and will be attempting to upload them tonight.

Ashley is back on Tuesday, and we intend to finalize final distribution of WSCT Critical Habitat as soon as we can...we have a very ambitious schedule to get the draft RS/AP together for review. Your support is essential and greatly appreciated!

Thanks, Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the

most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Watson, Ernest

From: Doolittle, Andrew
Sent: Wednesday, February 20, 2019 2:36 PM
To: Watson, Ernest
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

No problem!

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-20-19 12:59 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Already been looking at them! Fantastic work! Will work to refine, bringing in Carolyn for discussion, tomorrow and beyong.

Thanks Andrew! Ernie.

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 11:54 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Hi – all maps are in the folder... with 6 minutes to spare ☺

I would have liked to spend a little more time 'prettying' up the maps and fix/add some of the waterbody names, but with the short turnaround it'll have to do for now.

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-20-19 11:21 AM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Looks good to me! There will be outliers (i.e. small unconnected dot of Near Pure in the upper middle left) to clean up over the next couple days, but this is good for AEP to see.

Thanks Andrew!

Ernie

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 9:50 AM

To: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Cc: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Hi – I put a couple of maps in the folder – please let me know if everything looks ok to you (legend, etc.).

Thanks,
Andrew

From: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Sent: February-20-19 9:29 AM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

Hi Andrew,

I'm not sure if Ernie replied yet but I can help with the questions.

1. Remove the CH as well for the segments that were circled.
2. I'm not sure what the wording is in the template, but in the rule-set that Alberta provided they titled these segments as "Above barrier – no fish documented". We are submitting these maps to Alberta for review, so it would be helpful if we were consistent with the wording that they used. Along those lines, could you change "undefined pure" to "Pure – Low confidence" and "undefined Near Pure" to " Near Pure – Low Confidence", again to be consistent with the way Alberta has termed these categories.
3. These will still be maps for review.

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 8:12 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW
Importance: High

Thanks Ernie – the data has been updated, just a couple final questions before getting to the maps.

You requested:

1. Map with all categories in respective colours
2. FINAL map with proposed CH as green with existing (2014) CH in red (or something similar)

My Questions:

1. There are areas where you said to remove the streams – some of which have some existing CH ... I am assuming that you want me to remove the CH represented in those areas as well?
2. There are some examples where you said to add "no fish documented" segments – the wording is slightly different in the GIS layer, so hopefully I captured what you were thinking... I am assuming it was any stream segments that fill in the gaps in those areas?
3. Am I just using the template that Andrew G. put together or do you want me to make adjustments to the content of the map? Guess I am just wondering if these are still going to be maps for 'review', as opposed to 'published'. The quickest way to get this done by lunch is using the existing template.

Thanks,
Andrew

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-19-19 5:29 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HIGHWOOD / JUMPINGPOUND / KANANSKIS / OLDMAN below reservoir / SHEEP / UPPER OLDMAN / WILLOW

The rest...

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 3:17 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: GHOST RIVER and ELBOW RIVER (2 options)

From: Watson, Ernest
Sent: Tuesday, February 19, 2019 1:12 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: CASTLE and CROWSNEST

Thanks Andrew! I have put notes right in the map.

If you have questions, please call me on my mobile [redacted]

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Tuesday, February 19, 2019 12:46 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi all – just wondering how your review is going?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-18-19 10:42 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

[redacted]

To meet our timelines to post to the registry prior to the house rising for the summer, we must ensure that Alberta Environment and Parks supports our approach before the document is sent for review: we want to provide them a draft product for endorsement...hopefully by tomorrow evening.

s.19(1)

Andrew G. has talked to Andrew D. about the approach to the exercise he did today, and where he has stored the files he has been working from. I copied you on an example of draft products that were produced and continue to modify. I will be working with Ashley tomorrow morning to complete the rest of the maps, and will likely be asking Andrew his assistance in excising the identified reaches from the maps in the afternoon.

We will continue to produce better drafts over the next couple days, and we will fully engage you Thursday to work on refining them.

As always, we truly appreciate the support you and Andrew provide us.

Ernie

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 5:50 PM
To: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Hi Ernie – given the sensitivity of this species I think it would be good to give us a bit more time to get the maps made. I'll be back in the office on Thursday and can work on it then.

I hope you all agree and give us at least another day to meet your timelines.
Carolyn

From: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>
Sent: Monday, February 18, 2019 7:10 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>; Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: RE: HEADS UP: Westslope Cutthroat Trout Mapping!

Ernie, I am away tuesday-wednesday this week, and we do **not** have Monday (family day) off. I am only available today to work on this task. This mapping work has been ongoing between Ashley and Carolyn, and they did a significant amount of GIS work regarding the critical habitat. It sounds based on your description that the plan is to abandon the previous mapping work that was done and to use data that has been provided by the province of Alberta instead, is that

correct? Who will be providing direction on the mapping specifics, with Ashley away today? We need information regarding how many areas need to be mapped and their extent as soon as possible. Please call me immediately.

From: Watson, Ernest
Sent: February 17, 2019 9:15 PM
To: Geraghty, Andrew; Doolittle, Andrew
Cc: Gillespie, Ashley; Bakelaar, Carolyn; Curtis, Martyn
Subject: FW: HEADS UP: Westslope Cutthroat Trout Mapping!

Andrew and Andrew:

With Carolyn away, we will be relying on you to help out with producing the maps we require, which must be done by Thursday morning if we are going to be able to keep to our timelines. I will send you both a calendar invite for a call for first thing Tuesday morning to go over requirements.

Ernie.

From: Watson, Ernest
Sent: Sunday, February 17, 2019 6:04 PM
To: Bakelaar, Carolyn <Carolyn.Bakelaar@dfo-mpo.gc.ca>
Cc: Geraghty, Andrew <Andrew.Geraghty@dfo-mpo.gc.ca>; Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Mapping!
Importance: High

Hello Carolyn / Andrew:

I think Ashley has already done so, but want to give you the warning that Martyn received the shape files for the genetic distributions for Westslope on Friday and will be attempting to upload them tonight.

Ashley is back on Tuesday, and we intend to finalize final distribution of WSCT Critical Habitat as soon as we can...we have a very ambitious schedule to get the draft RS/AP together for review. Your support is essential and greatly appreciated!

Thanks, Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>;

'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson
Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril

Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Ghost River (Case 1)

MARGARET CREEK
LOOKOUT CREEK
JOHNSON CREEK
MEADOW CREEK
LOST KNIFE CREEK
AURA CREEK
WAIPAROUS CREEK
GHOST RIVER
BAYMAR CREEK

Westslope Cutthroat Trout
(Saskatchewan - Nelson River Populations)
Oncorhynchus clarkii lewisi

- Existing CH

Classification

- Above barrier - no fish documented
- Pure
- Pure - Low confidence
- Near Pure
- Near Pure - Low confidence
- First Nations
- Park
- HUC 8

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

0 3.75 7.5 15 km

000175

Ghost River (Case 1)

MARGARET CREEK
LOOKOUT CREEK
JOHNSON CREEK
MEADOW CREEK
LOST KNIFE CREEK
AURA CREEK
WAIPAROUS CREEK
GHOST RIVER
BAYMAR CREEK

Westslope Cutthroat Trout

(Saskatchewan - Nelson River Populations)

Oncorhynchus clarkii lewisi

- Proposed CH
- First Nations
- Park
- HUC 8

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

0 3.75 7.5 15 km

000176

Ghost River (Case 2)

MARGARET CREEK
LOOKOUT CREEK
JOHNSON CREEK
MEADOW CREEK
LOST KNIFE CREEK
AURA CREEK
WAIPAROUS CREEK

Westslope Cutthroat Trout

(Saskatchewan - Nelson River Populations)

Oncorhynchus clarkii lewisi

Existing CH

Classification

- Above barrier - no fish documented
- Pure
- Pure - Low confidence
- Near Pure
- Near Pure - Low confidence
- First Nations
- Park
- HUC 8

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

0 3.75 7.5 15 km

000177

Ghost River (Case 2)

MARGARET CREEK
LOOKOUT CREEK
JOHNSON CREEK
MEADOW CREEK
LOST KNIFE CREEK
AURA CREEK
WAIPAROUS CREEK

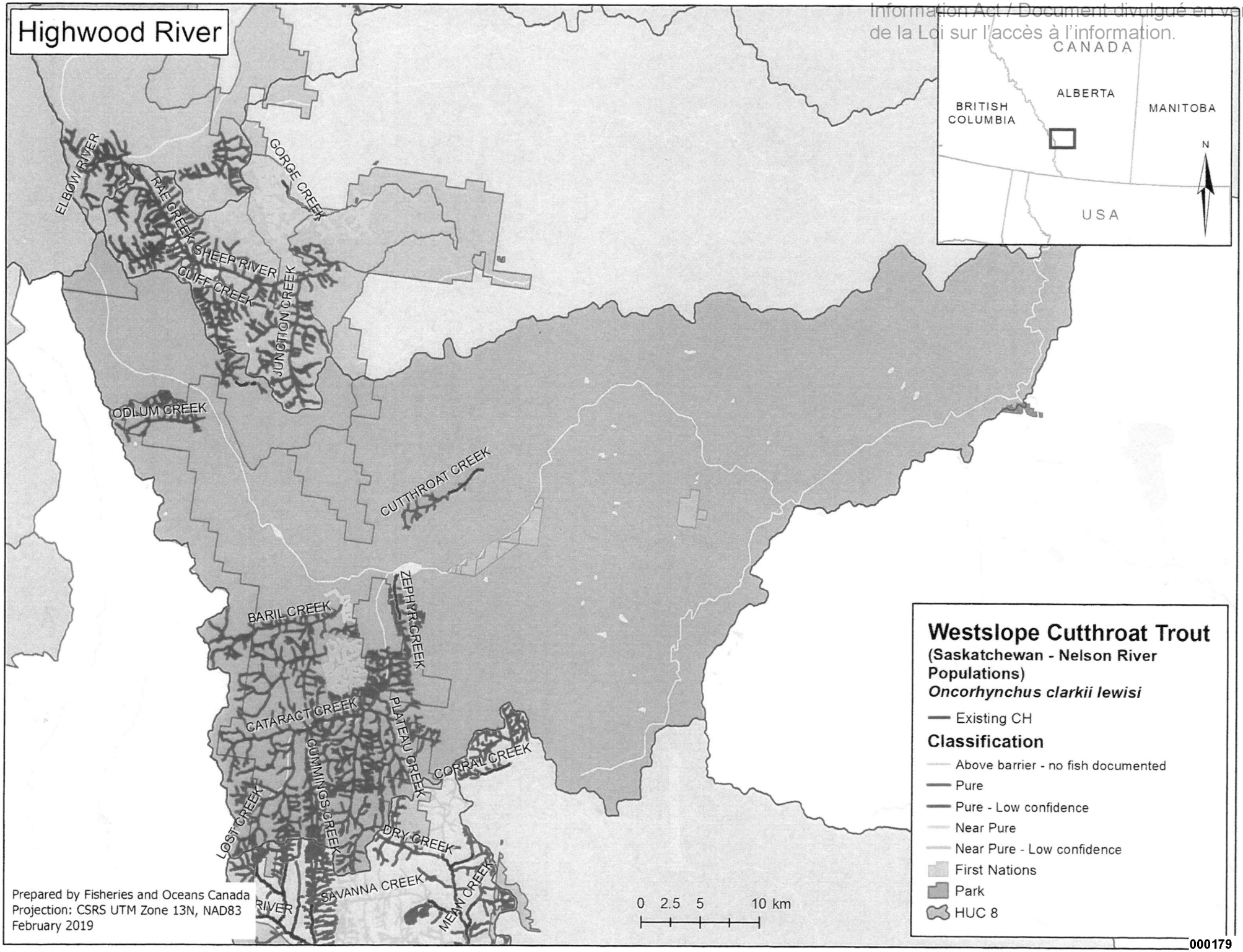
Westslope Cutthroat Trout
(Saskatchewan - Nelson River Populations)
Oncorhynchus clarkii lewisi

- Proposed CH
- First Nations
- Park
- HUC 8

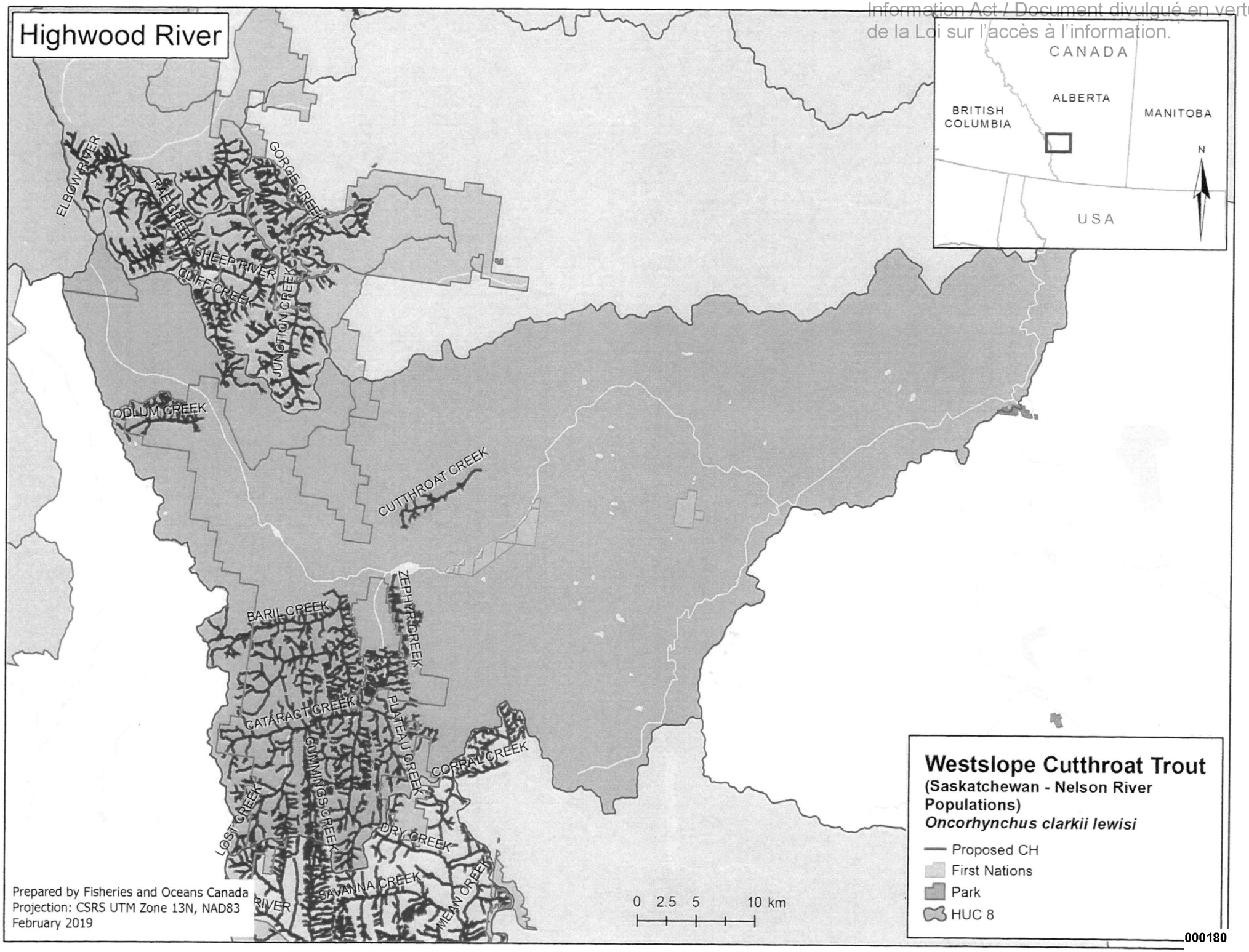
Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

0 3.75 7.5 15 km

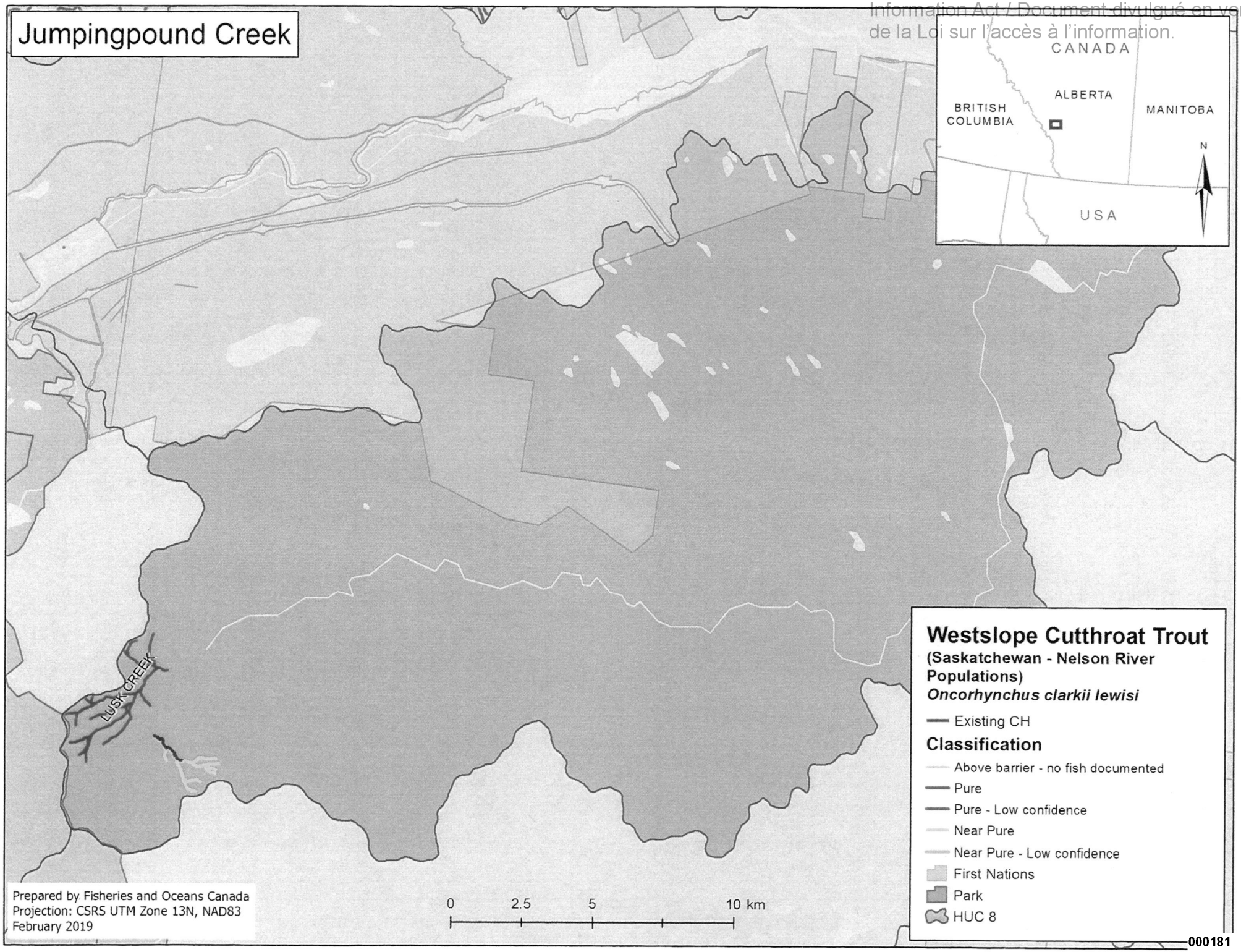
000178

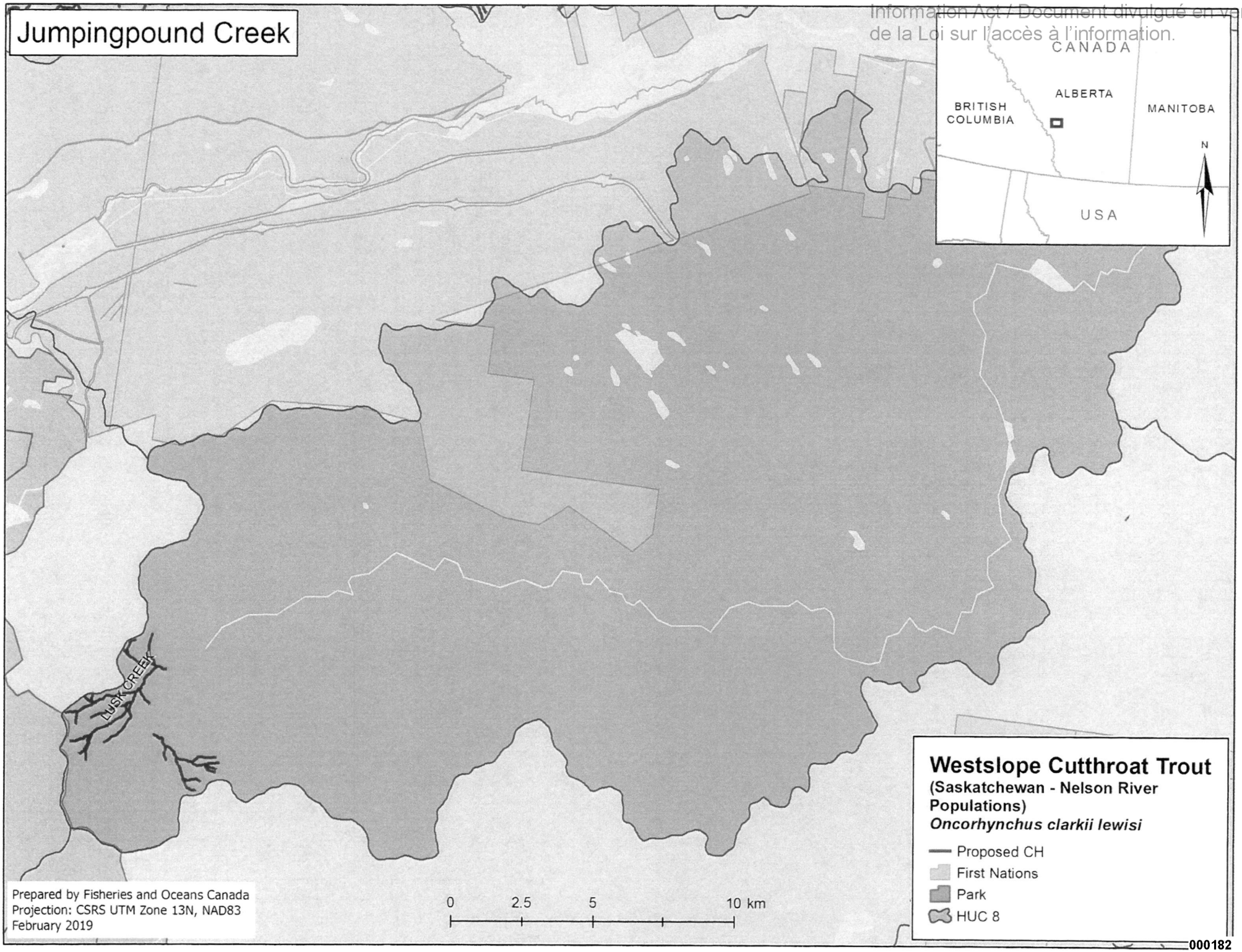


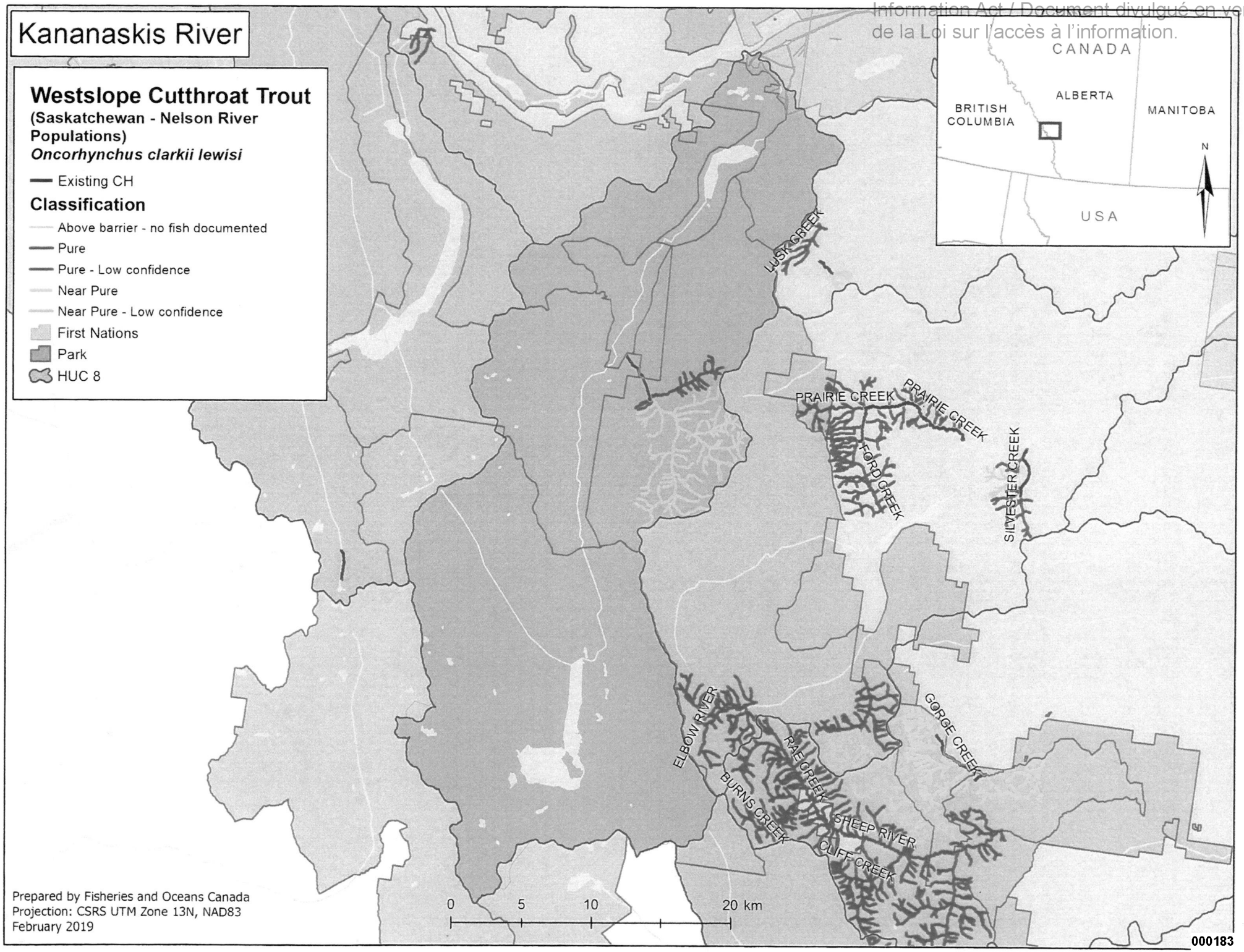
000179



000180







000183

Kananaskis River

Westslope Cutthroat Trout
(Saskatchewan - Nelson River Populations)
Oncorhynchus clarkii lewisi

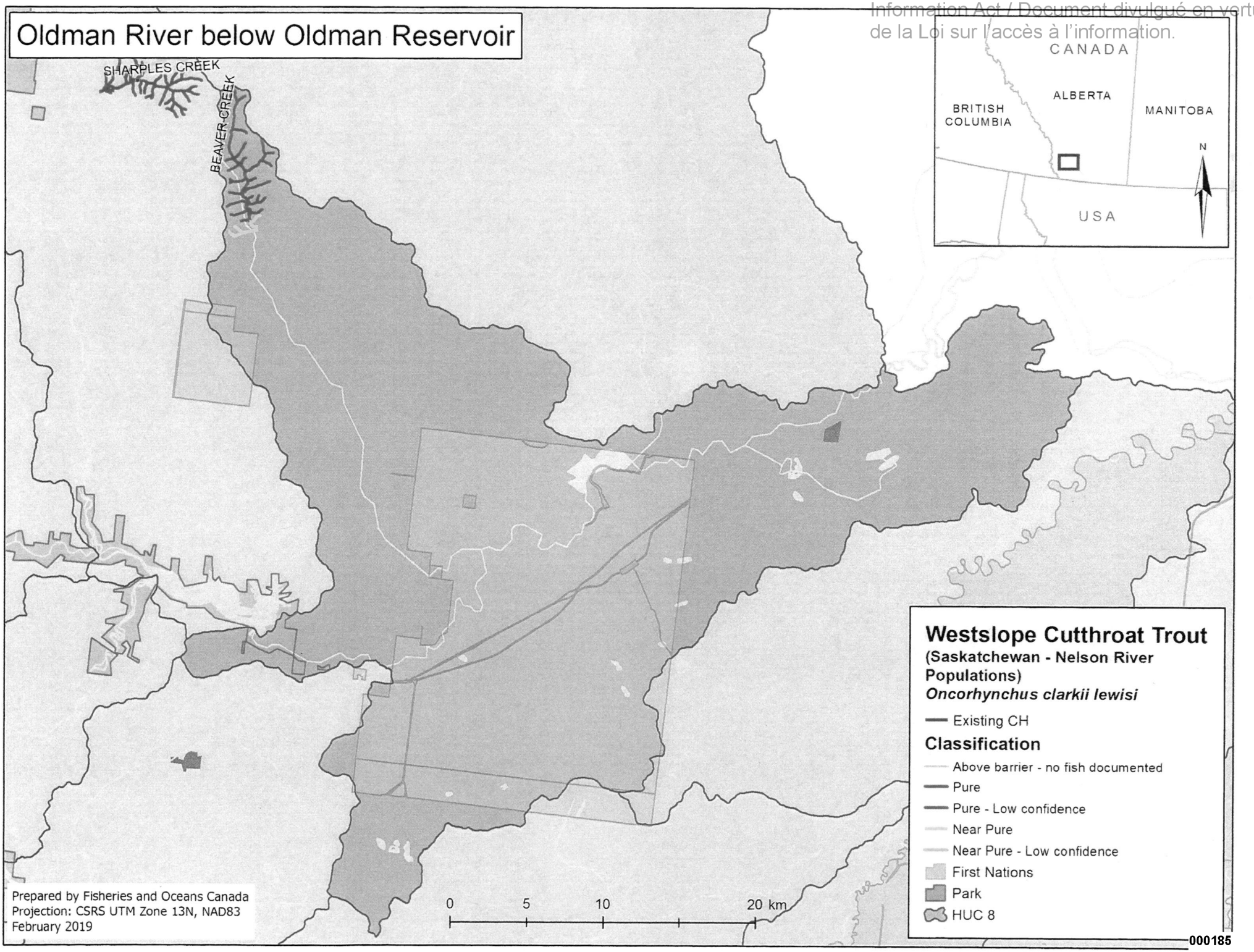
- Proposed CH
- First Nations
- Park
- HUC 8

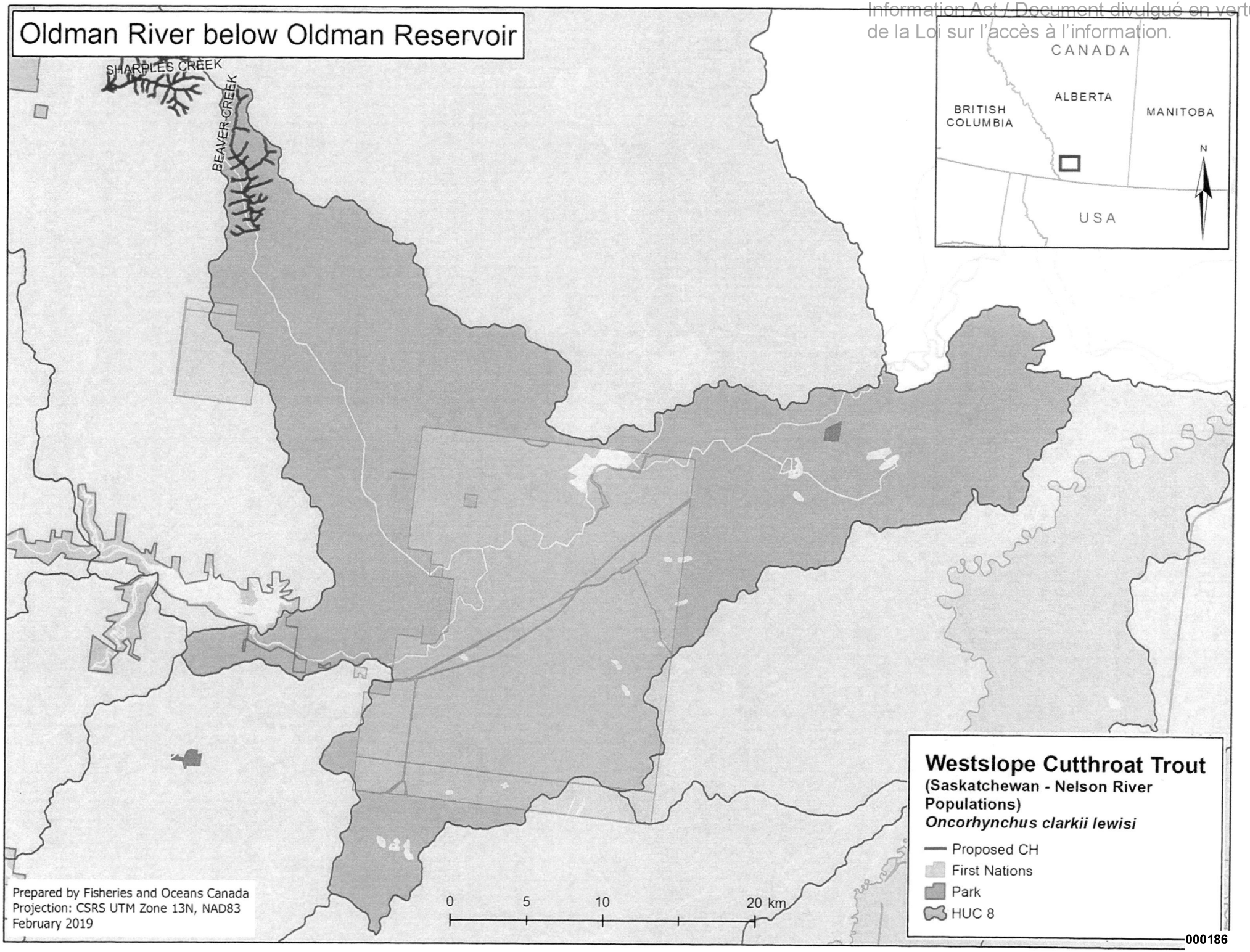
LUSK CREEK
PRAIRIE CREEK
PRAIRIE CREEK
FORD CREEK
SILVESTER CREEK
ELBOW RIVER
RAE CREEK
BURNS CREEK
GORGE CREEK
SHEEP RIVER
CLIFF CREEK

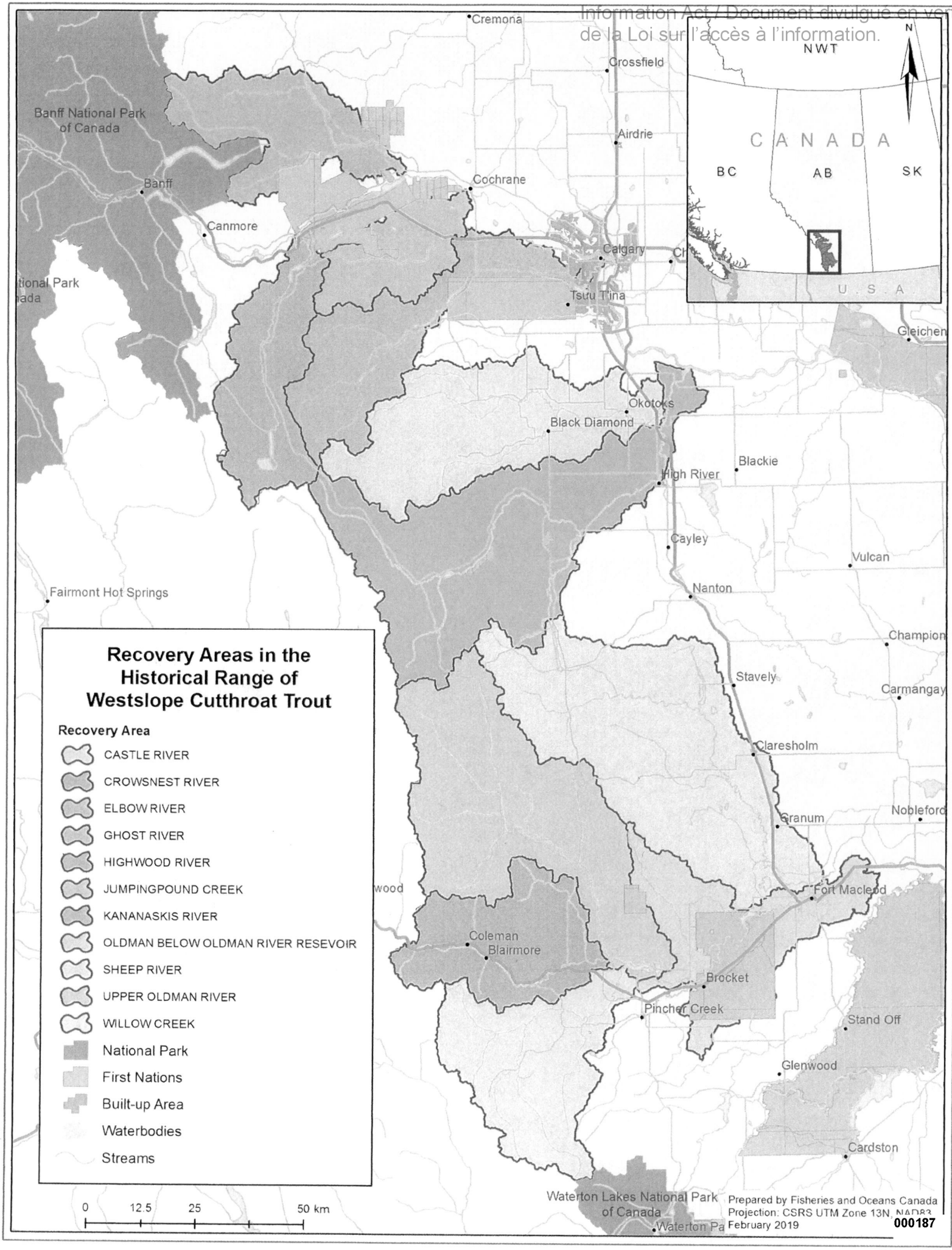
0 5 10 20 km

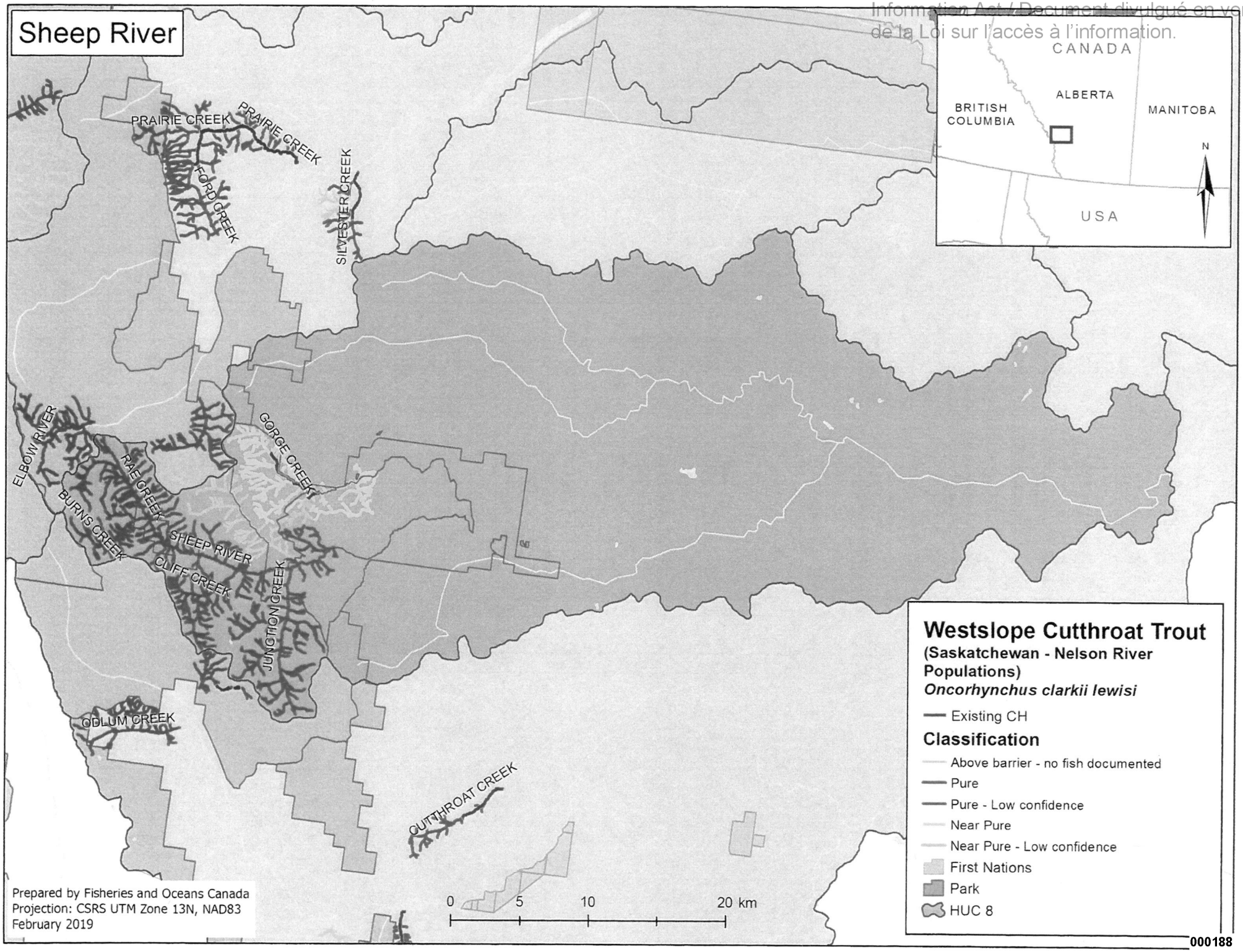
Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

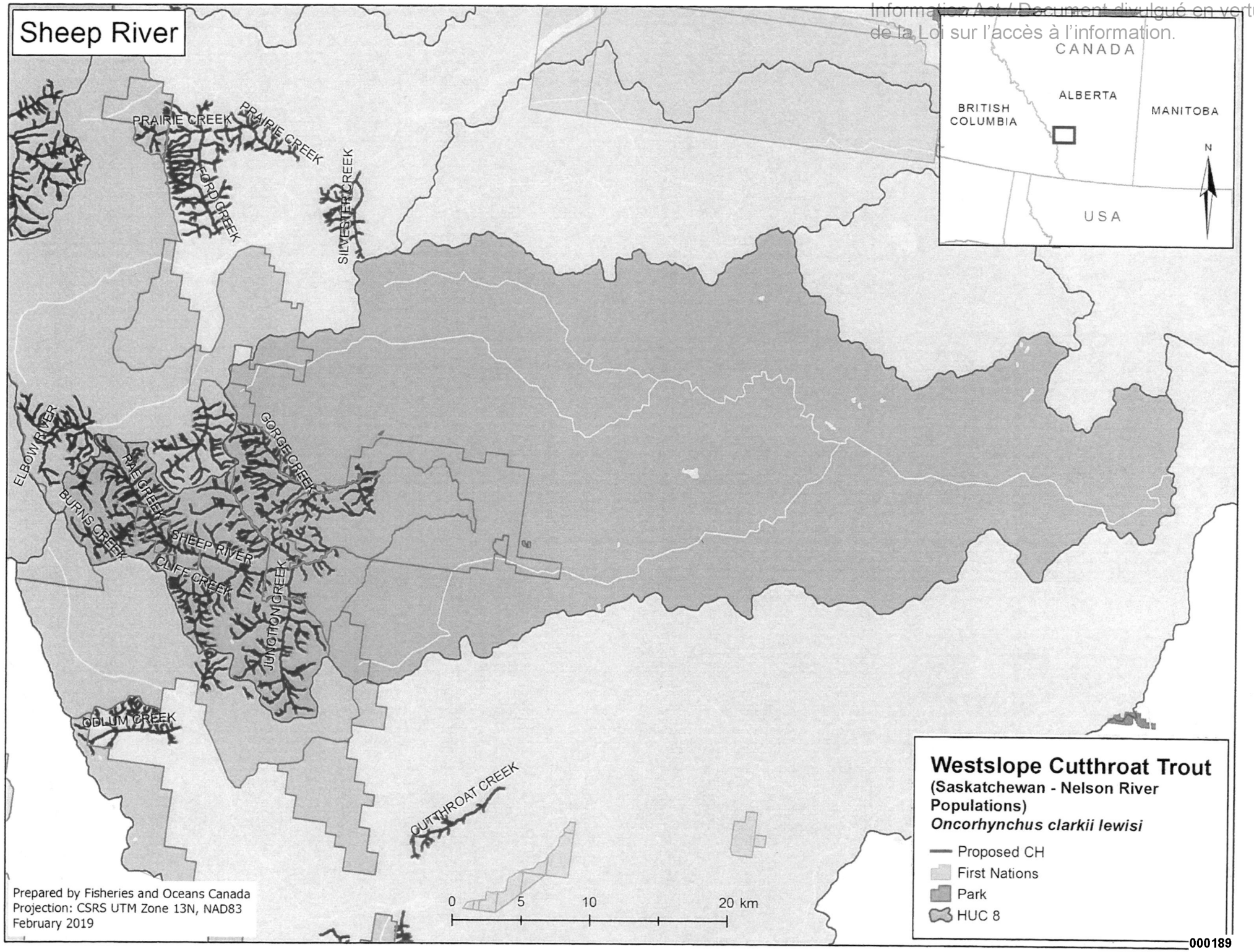
000184

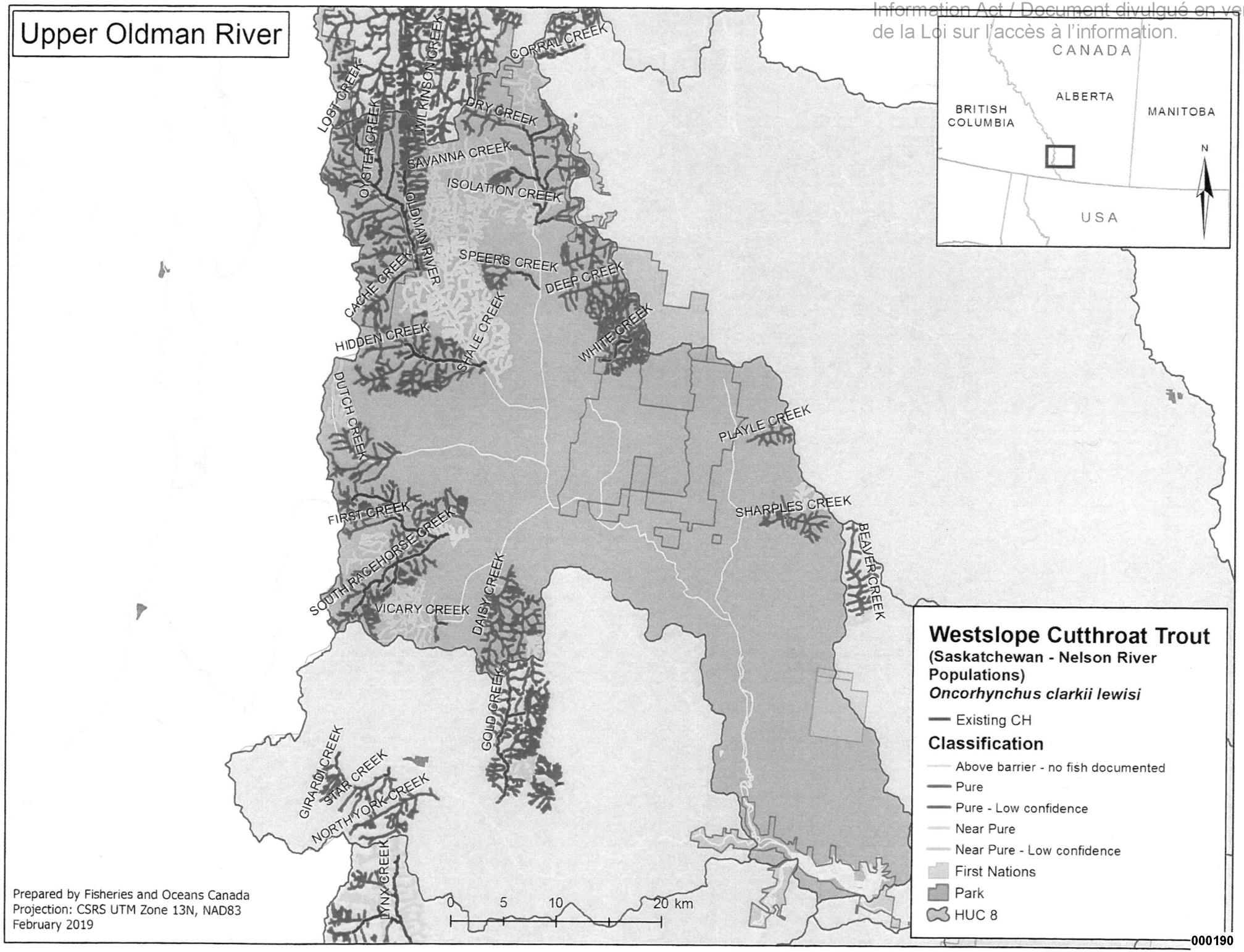


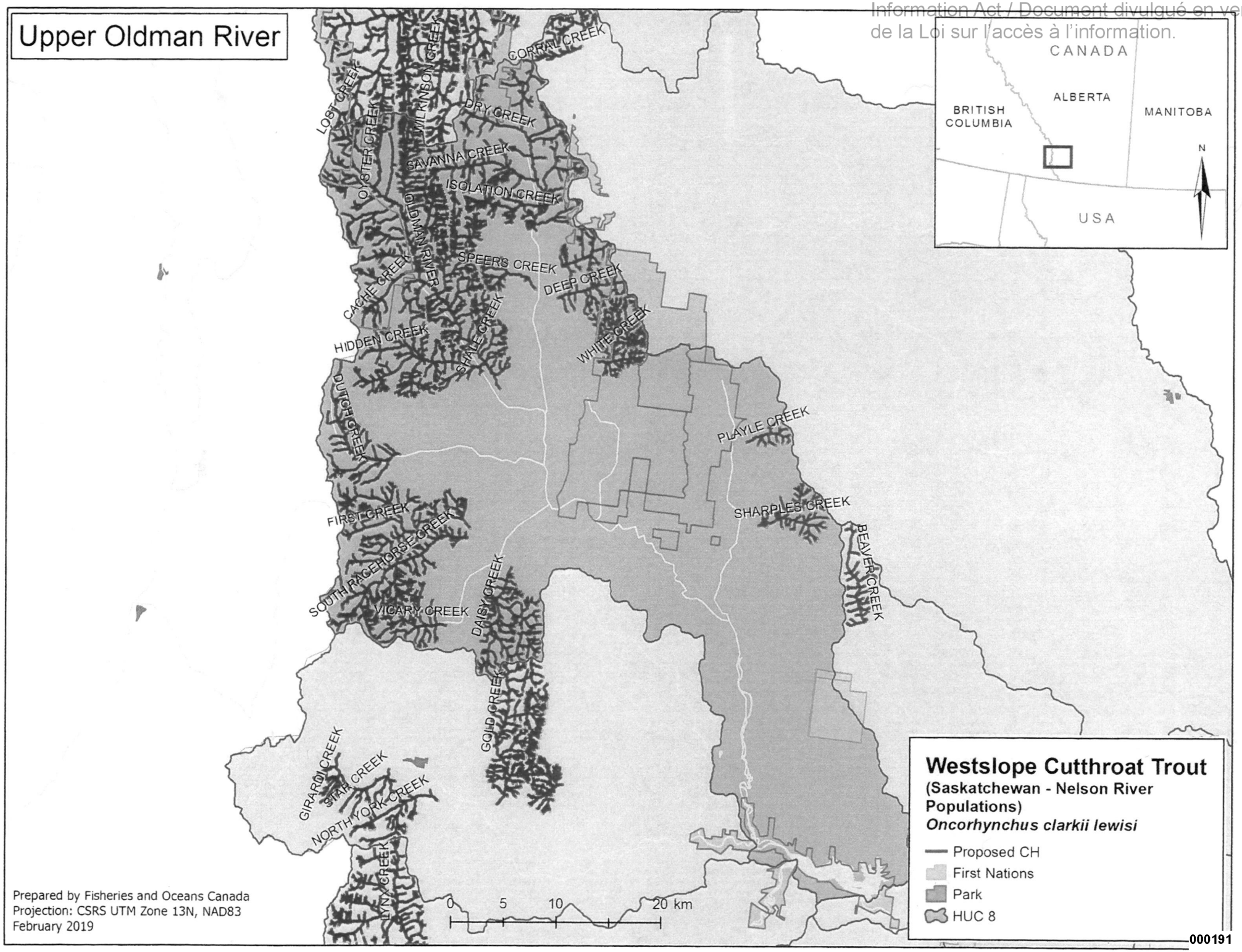




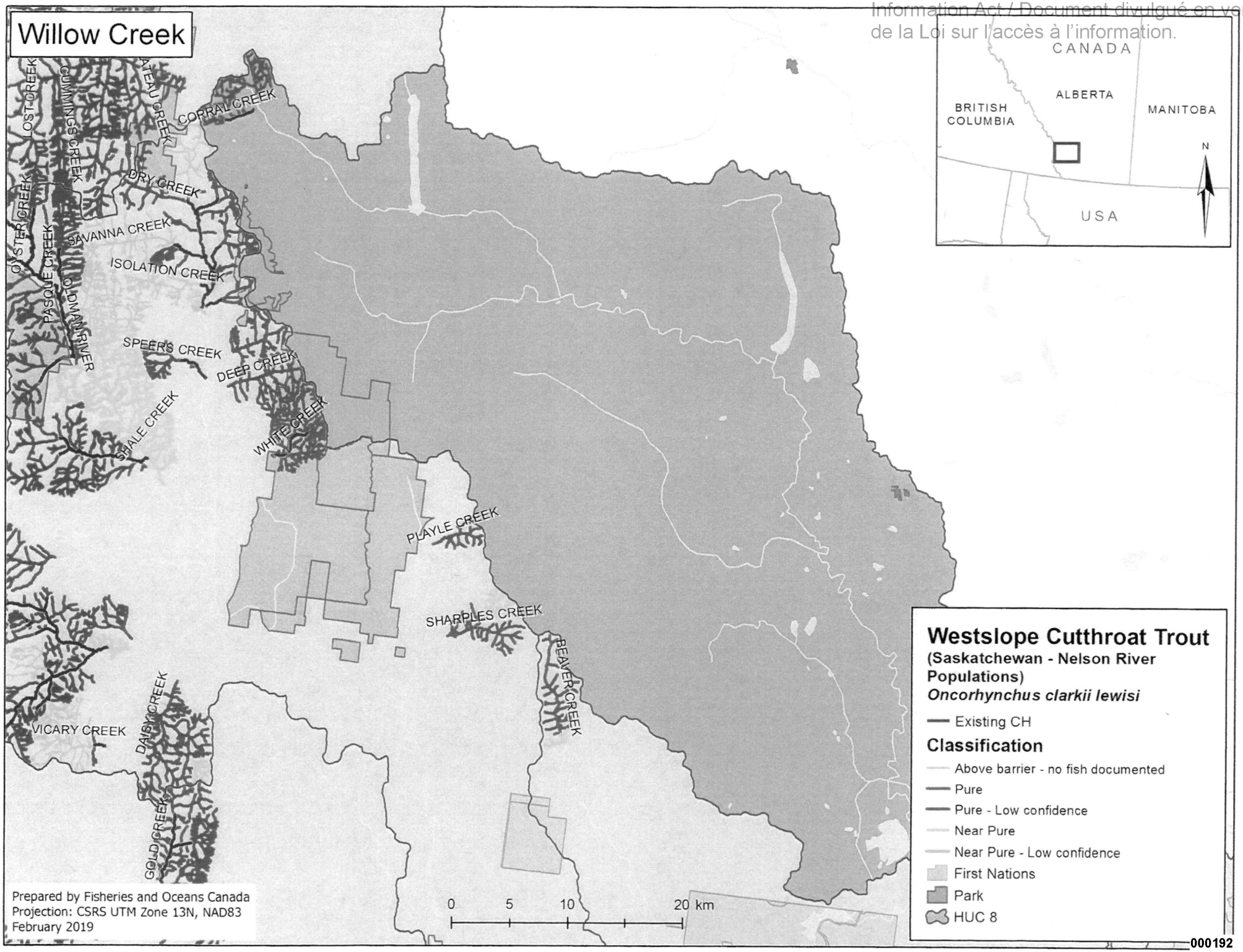




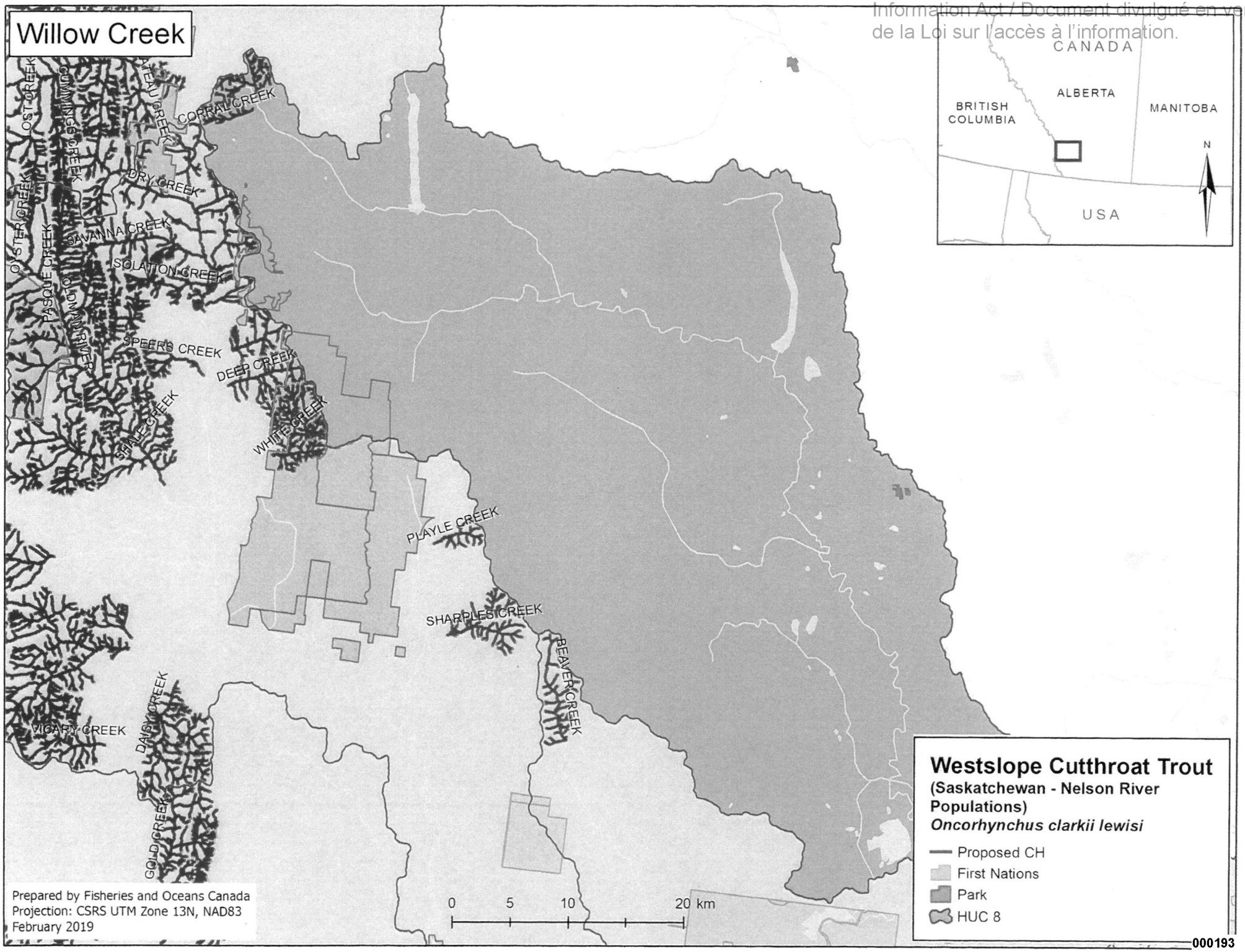


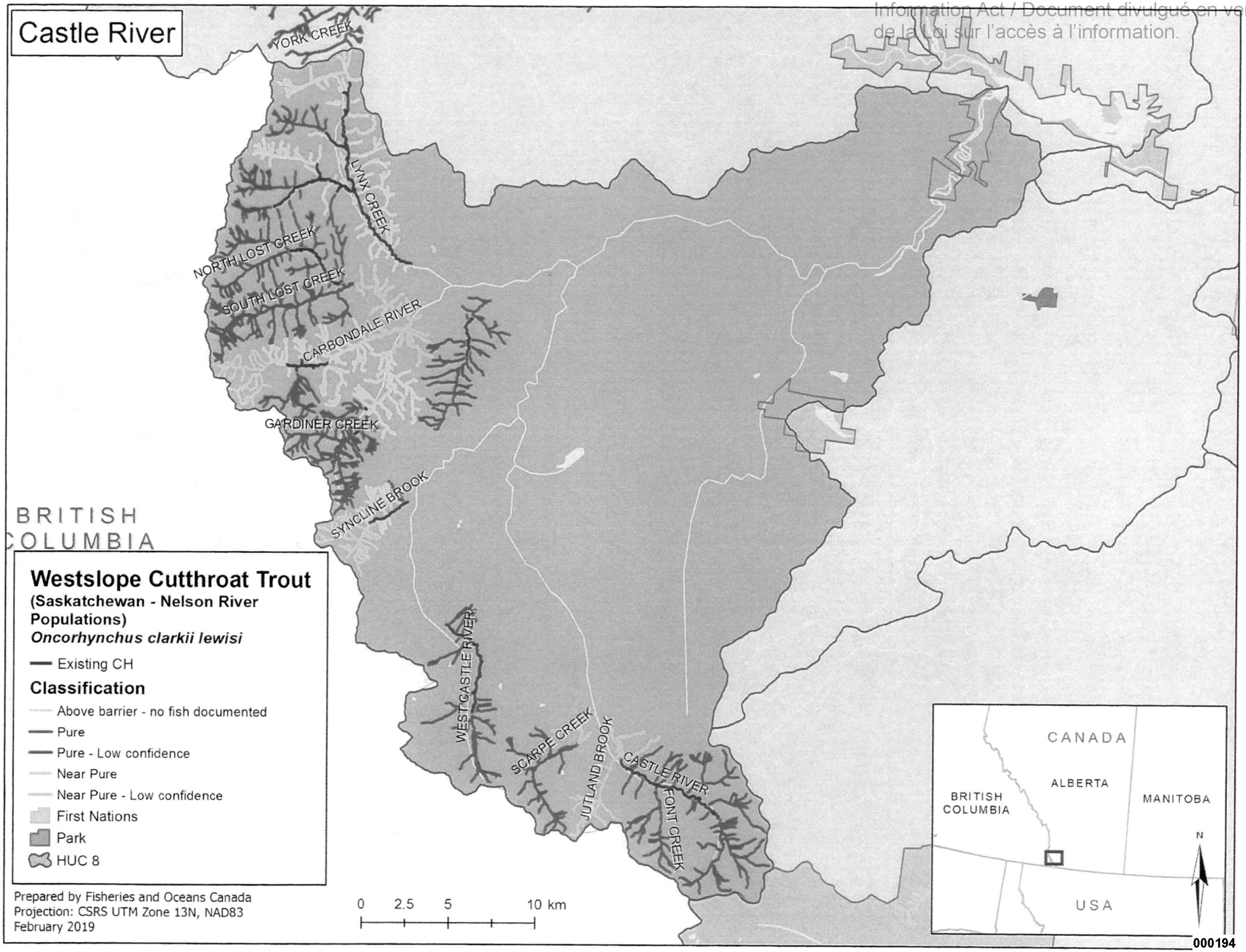


000191

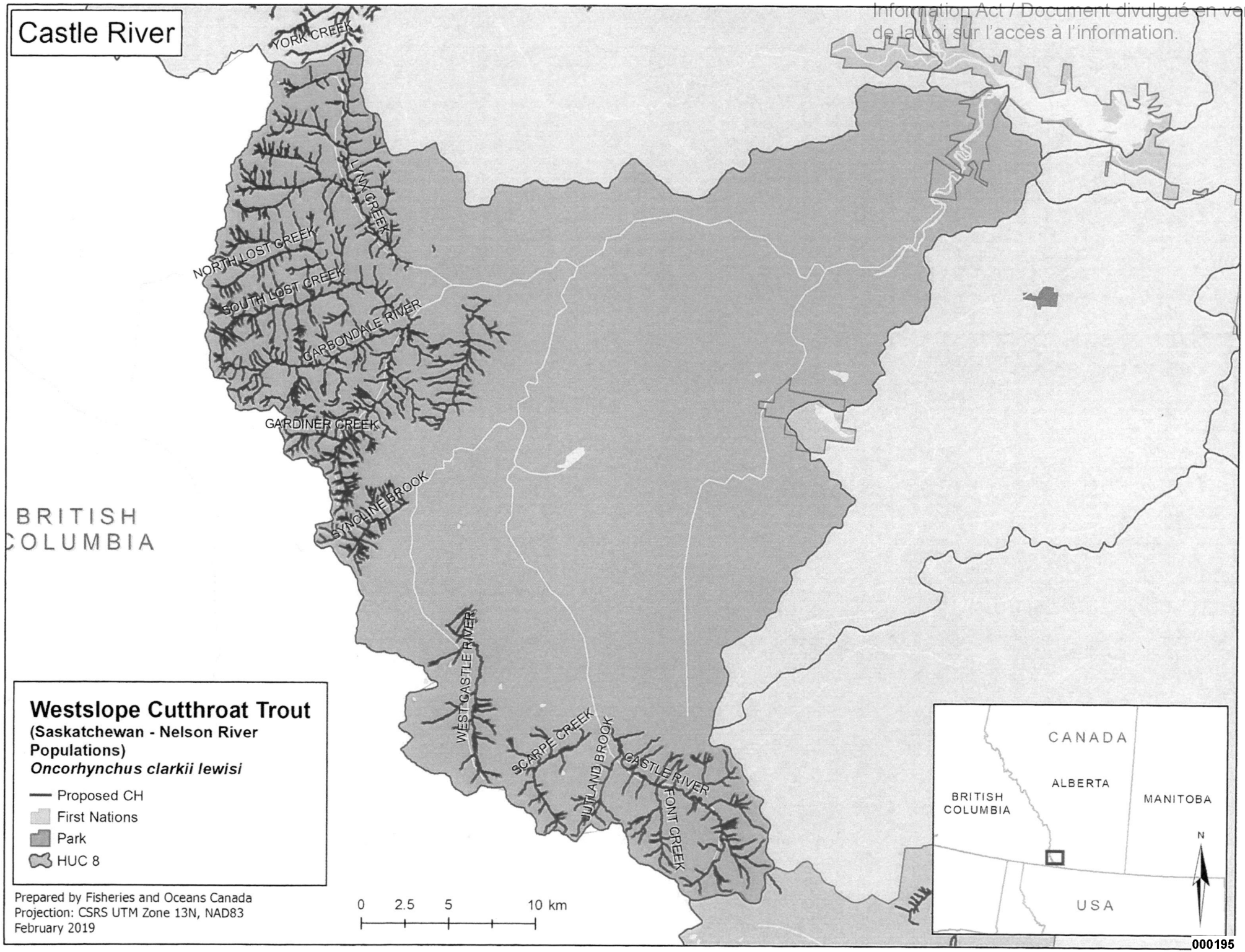


000192

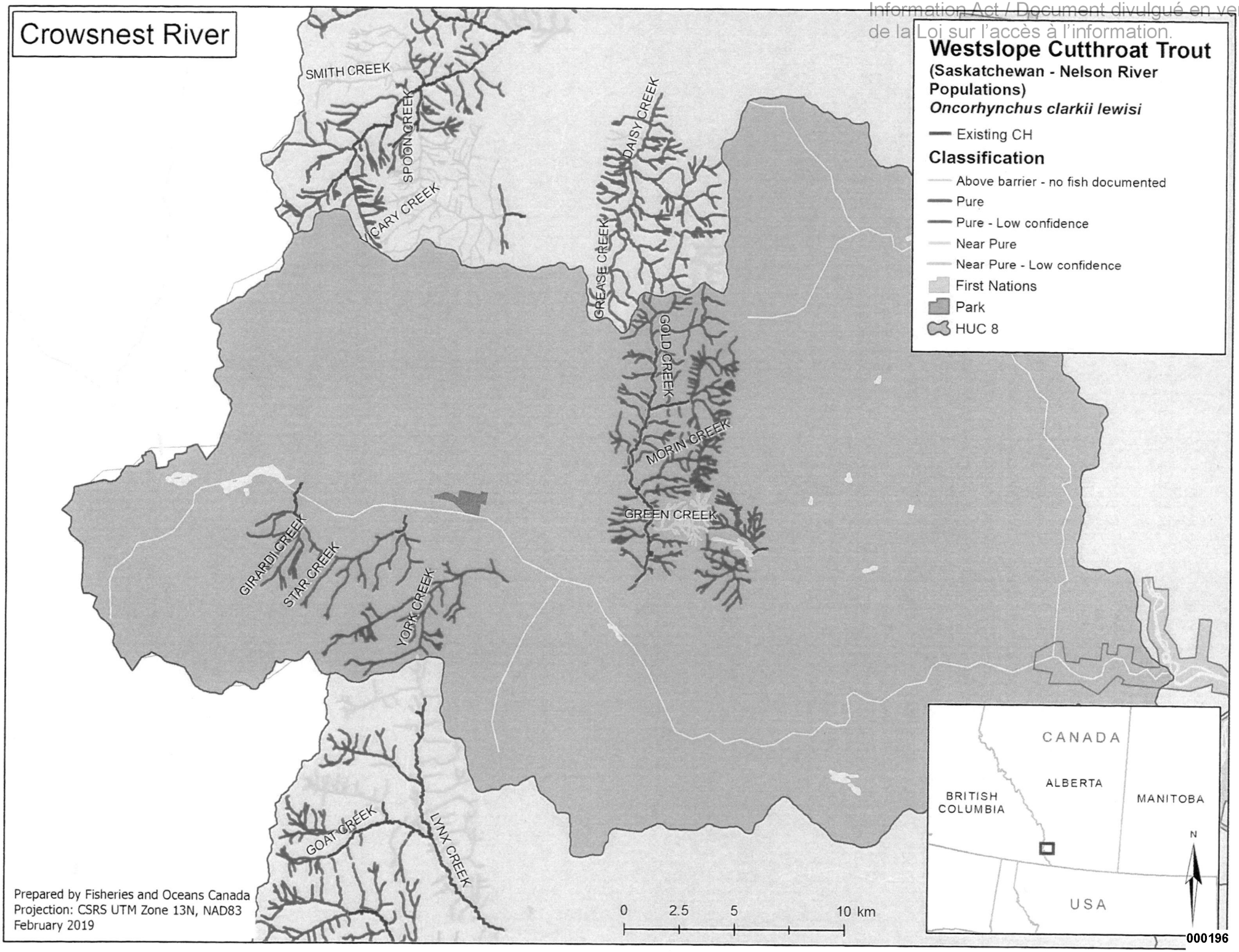




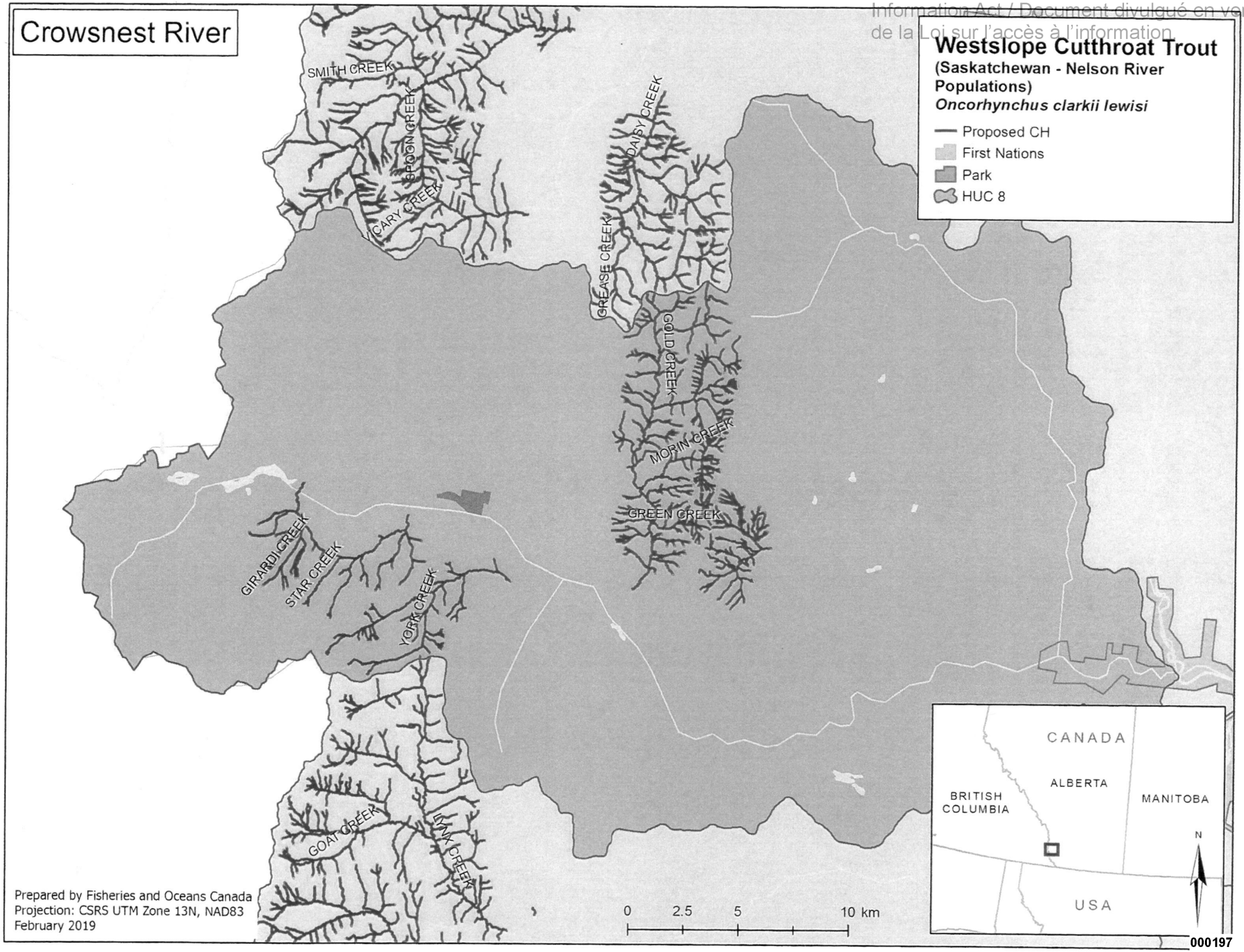
000194



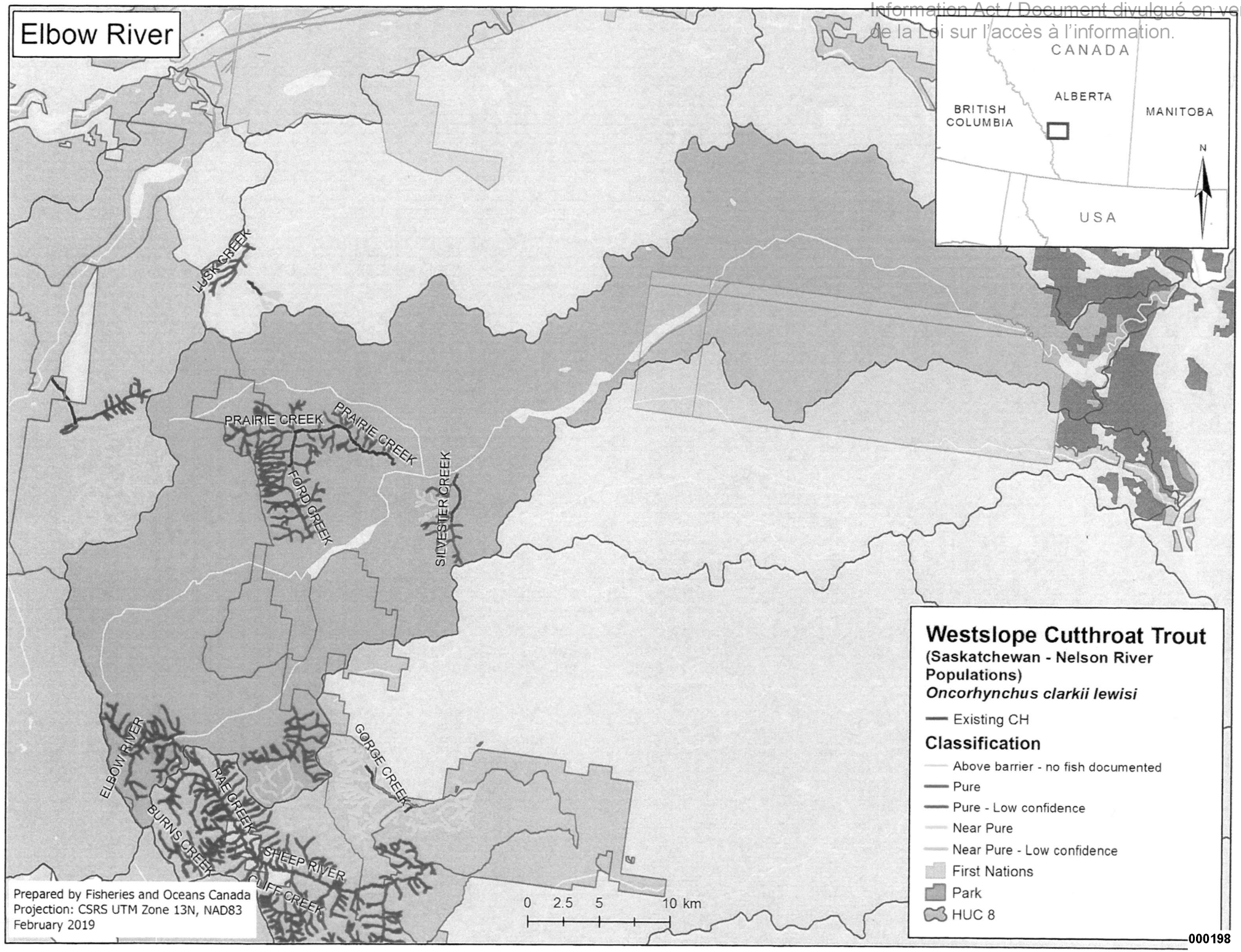
000195



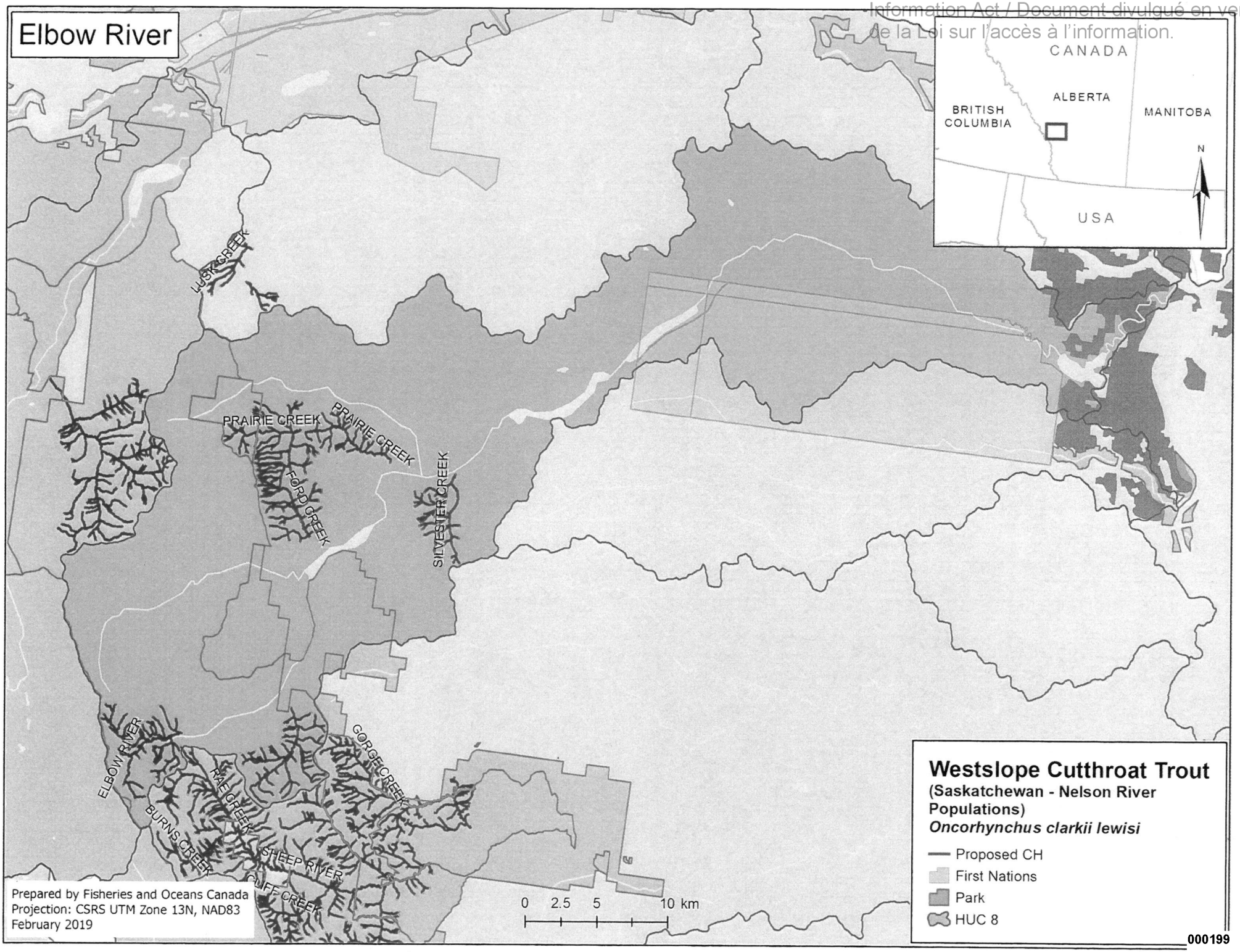
000196



000197



000198



000199

Lacho, Christine

From: Watson, Ernest
Sent: Wednesday, February 20, 2019 3:20 PM
To: Craig Johnson; Sue Cotterill; Rob Simieritsch
Cc: Curtis, Martyn; Gillespie, Ashley; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 1 of 4 (CASTLE / CROWSNEST / ELBOW)
Attachments: ElbowRiver_ProposedCH.jpg; CastleRiver_Classification.jpg; CastleRiver_ProposedCH.jpg; CrowsnestRiver_Classification.jpg; CrowsnestRiver_ProposedCH.jpg; ElbowRiver_Classification.jpg

Please note, the following current CH has been proposed for removal based on the ruleset:
CROWSNEST
- Allison Creek
- Blarimore Creek
- Tributary of Todd Creek
- Tributary of Goat Creek

Page 201

is a duplicate of

est un duplicata de la

page 196

Page 202

is a duplicate of

est un duplicata de la

page 195

Page 203

is a duplicate of

est un duplicata de la

page 194

Page 204

is a duplicate of

est un duplicata de la

page 199

Page 205

is a duplicate of

est un duplicata de la

page 198

Page 206

is a duplicate of

est un duplicata de la

page 197

Lacho, Christine

From: Watson, Ernest
Sent: Wednesday, February 20, 2019 3:21 PM
To: Craig Johnson; Sue Cotterill; Rob Simieritsch
Cc: Curtis, Martyn; Gillespie, Ashley; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 3 of 4 (KANANASKIS / OLDMAN / SHEEP)
Attachments: SheepRiver_ProposedCH.jpg; KananaskisRiver_Classification.jpg; KananaskisRiver_ProposedCH.jpg; OldmanBelowOldmanReservoir_Classification.jpg; OldmanRiverBelowOldmanReservoir_ProposedCH.jpg; SheepRiver_Classification.jpg

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Pages 208 to / à 209

are duplicates of

sont des duplicatas des

pages 188 to / à 189

Page 210

is a duplicate of

est un duplicata de la

page 185

Page 211

is a duplicate of

est un duplicata de la

page 183

Page 212
is a duplicate of
est un duplicata de la
page 185

Page 213

is a duplicate of

est un duplicata de la

page 184

Lacho, Christine

From: Watson, Ernest
Sent: Wednesday, February 20, 2019 3:21 PM
To: Craig Johnson; Sue Cotterill; Rob Simieritsch
Cc: Curtis, Martyn; Gillespie, Ashley; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 4 of 4 (UPPPER OLDMAN / WILLOW)
Attachments: WillowCreek_ProposedCH.jpg; UpperOldmanRiver_Classification.jpg; UpperOldmanRiver_ProposedCH.jpg; WillowCreek_Classification.jpg

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Page 215

is a duplicate of

est un duplicata de la

page 190

Pages 216 to / à 217
are duplicates of
sont des duplicatas des
pages 192 to / à 193

Page 218

is a duplicate of

est un duplicata de la

page 191

Lacho, Christine

From: Watson, Ernest
Sent: Wednesday, February 20, 2019 4:47 PM
To: 'Paul Christensen'
Attachments: Willow Creek ERNIE Feb 19.jpg; Castle River ERNIE Feb 19.jpg; Crowsnest River ERNIE Feb 19.jpg; Elbow River ERNIE Feb 19.jpg; Ghost River ERNIE Feb 19.jpg; Highwood River ERNIE FEB 19.jpg; Jumpingpound Creek ERNIE Feb 19.jpg; Kananaskis River ERNIE Feb 19.jpg; Oldman below Oldman Reservoir ERNIE Feb 19.jpg; Sheep River ERNIE Feb 19.jpg; Upper Oldman River ERNIE Feb 19.jpg

From: Paul Christensen <Paul.Christensen@gov.ab.ca>
Sent: Wednesday, February 20, 2019 4:31 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Craig Johnson <Craig.Johnson@gov.ab.ca>; Andreas Luek <Andreas.Luek@gov.ab.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie,

Our team is reviewing this as we speak. I'm wondering if you have these available as shapefiles so that our team can do a more thorough review and verify some items?

Thanks

Paul

Paul Christensen
Senior Fisheries Biologist, Bow District
South Saskatchewan Region
Alberta Environment and Parks
Operations Division, Resource Management

#228, 213-1 Street West
Cochrane, AB, T4C 1B4

Phone: 403-851-2149
cell: 403-998-1544
fax: 403-932-2158
email: Paul.Christensen@gov.ab.ca

FWMIS external site at:
FWMIS (Fish & Wildlife Management Information System)

View FWMIS data on-line using the IMF (Internet Mapping Framework)

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 2:21 PM
To: Craig Johnson <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>

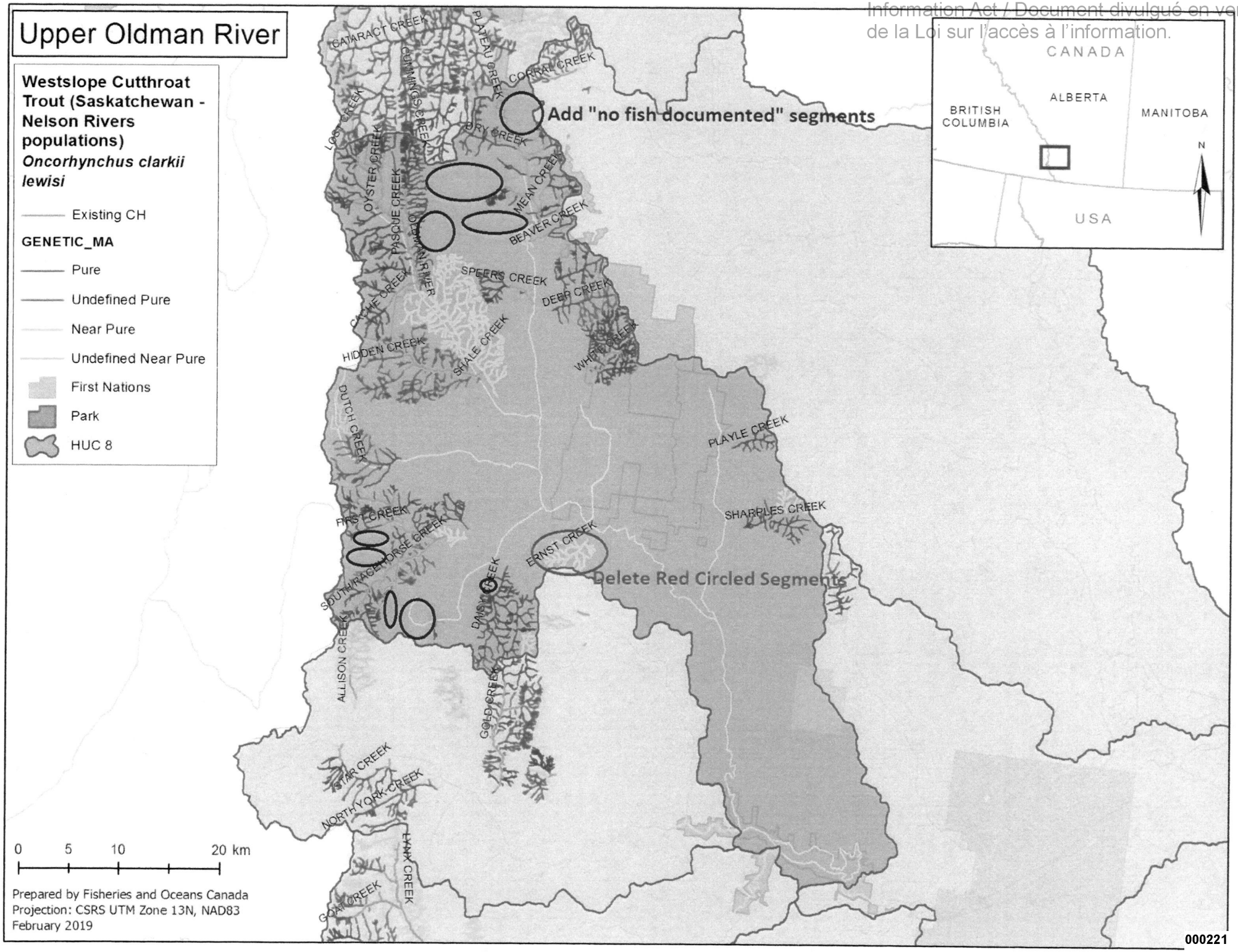
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Please note, the following current CH has been proposed for removal based on the ruleset:
HIGHWOOD
-Deep Creek
- Tributary of Flat River

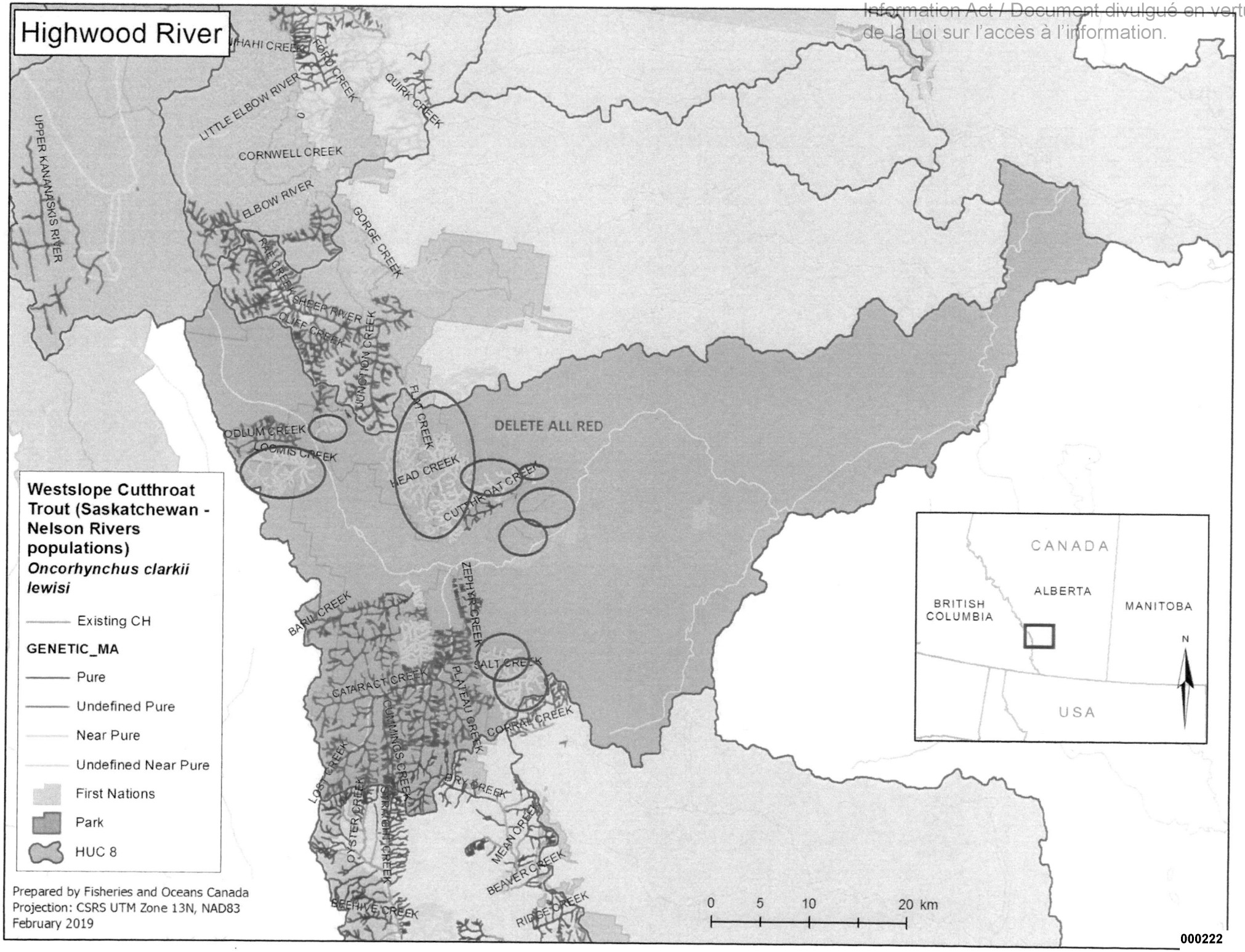
Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

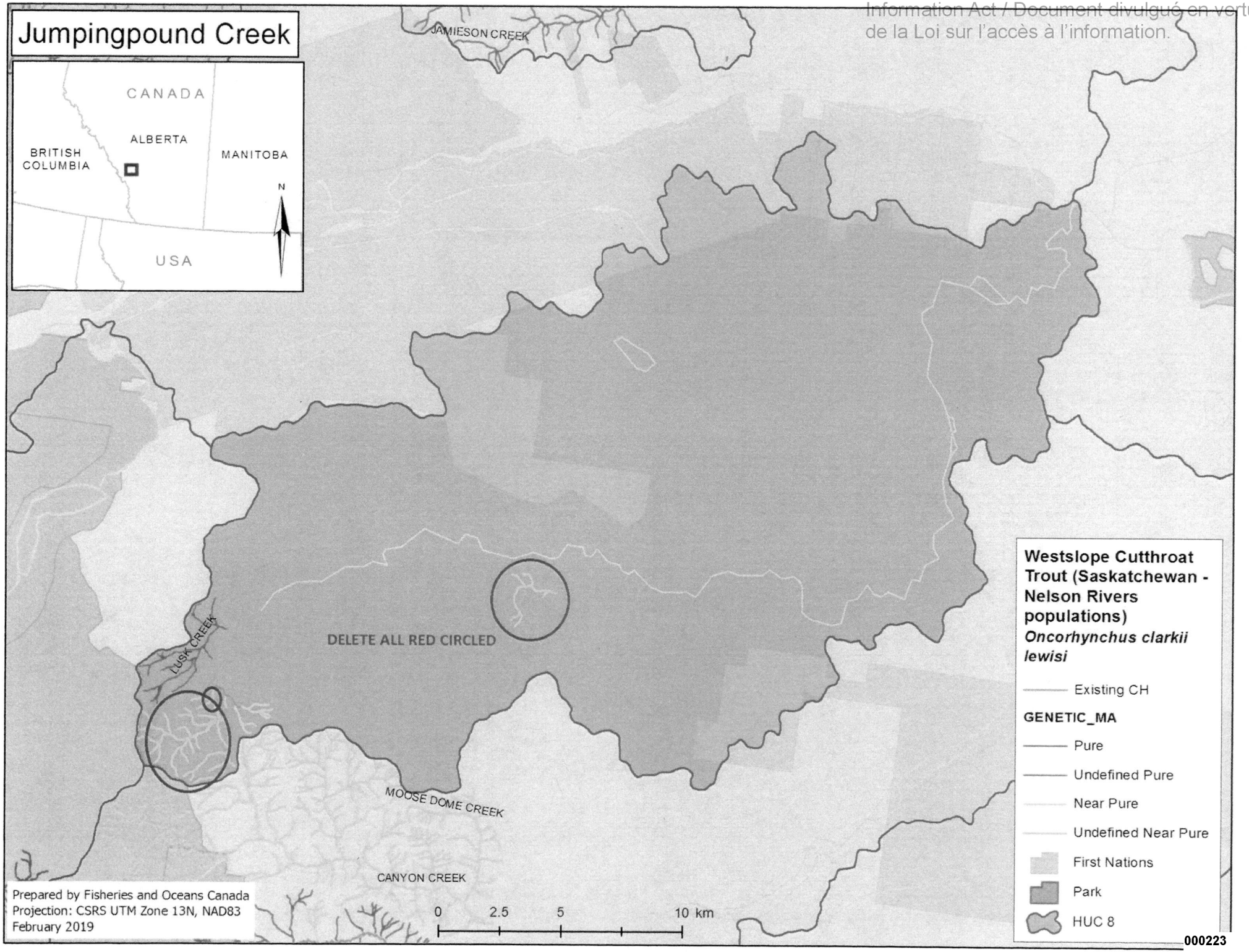
Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611



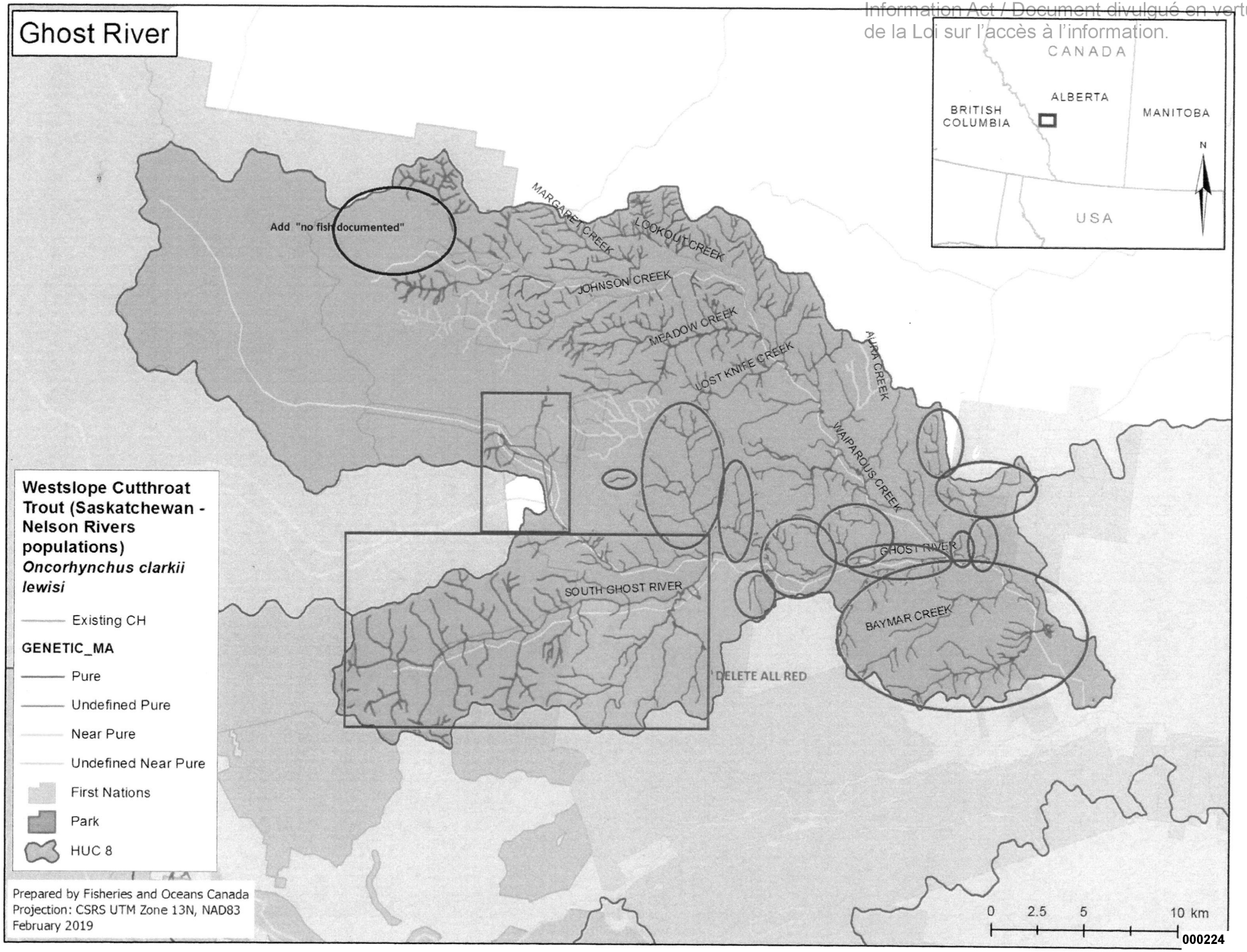
000221

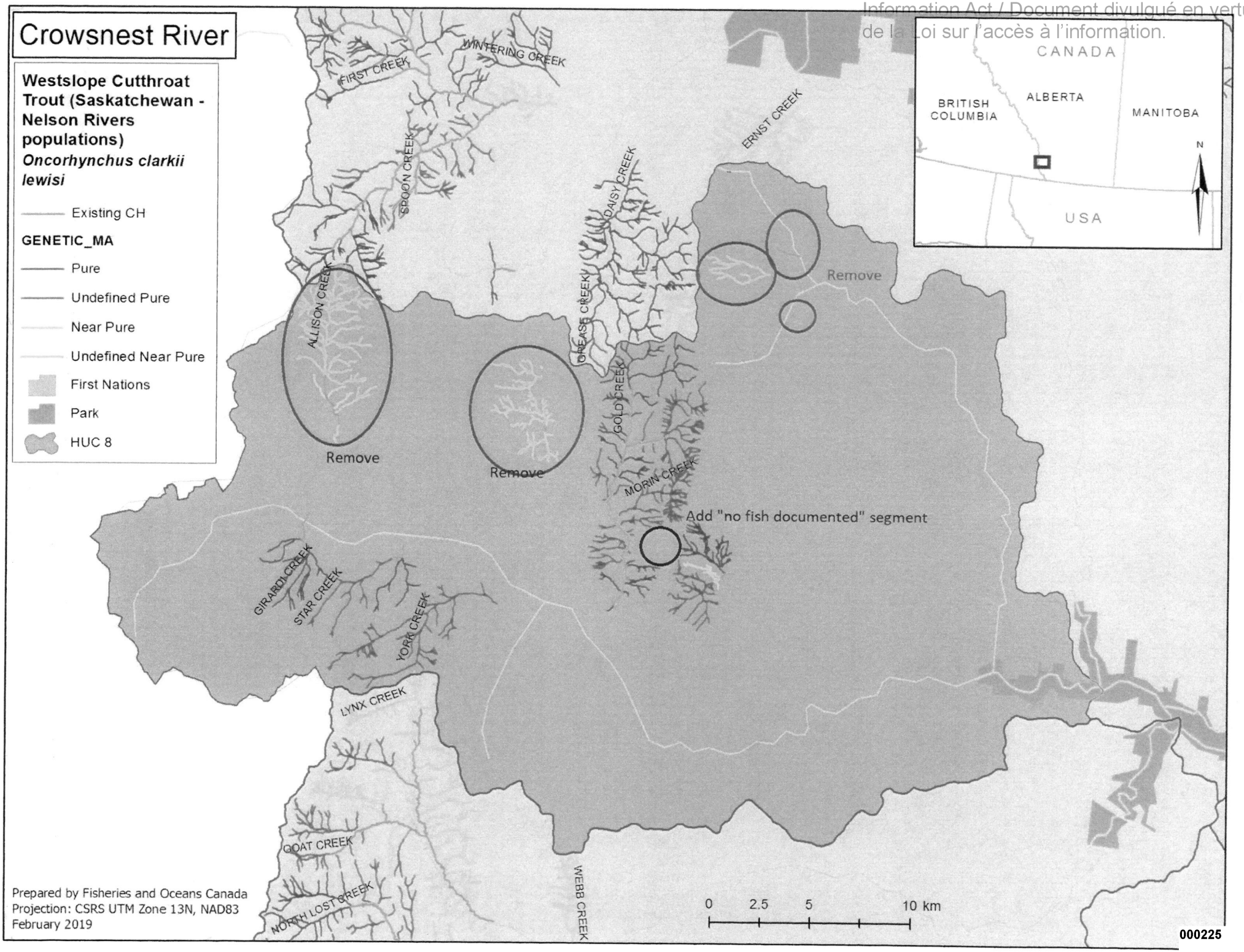


000222

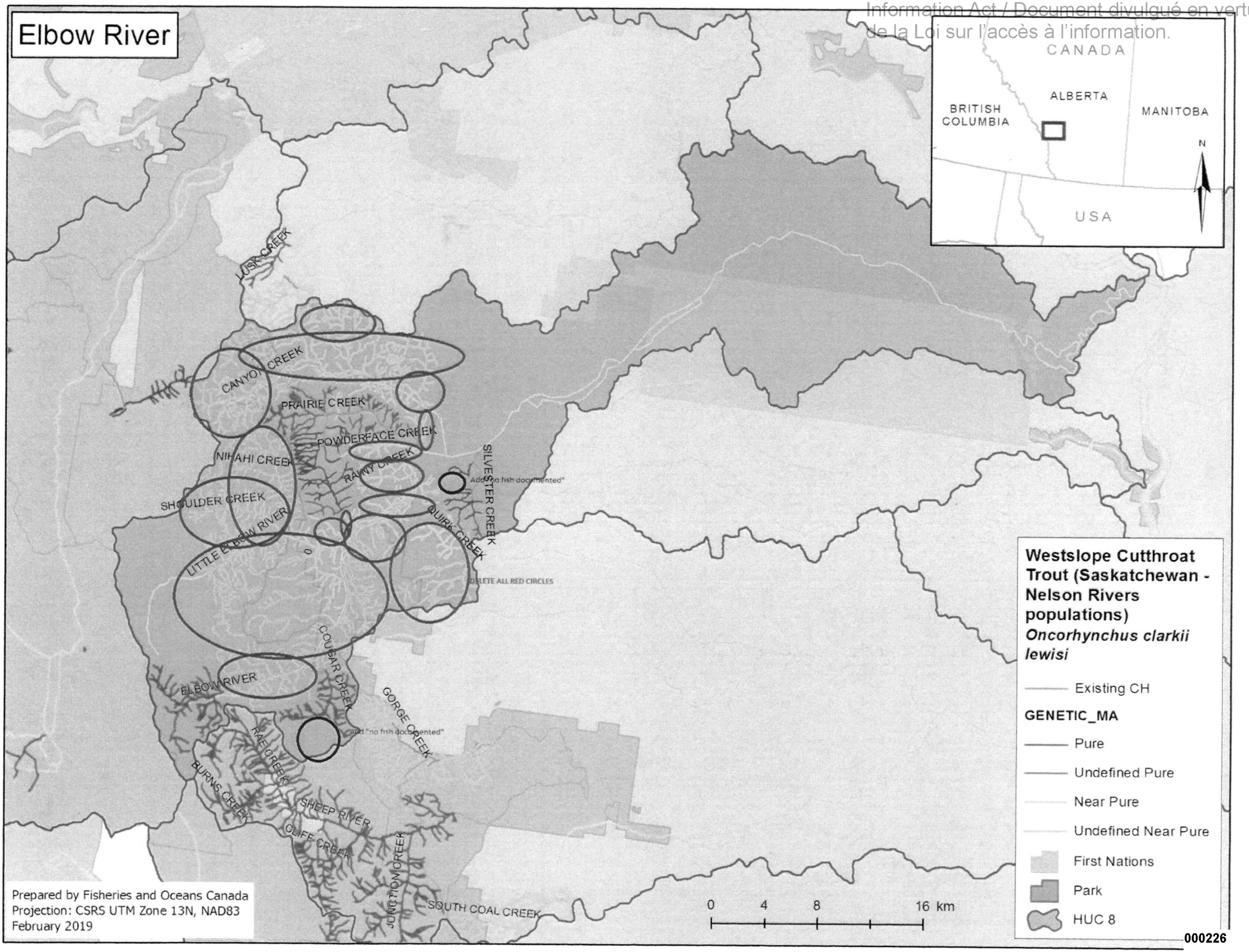


000223

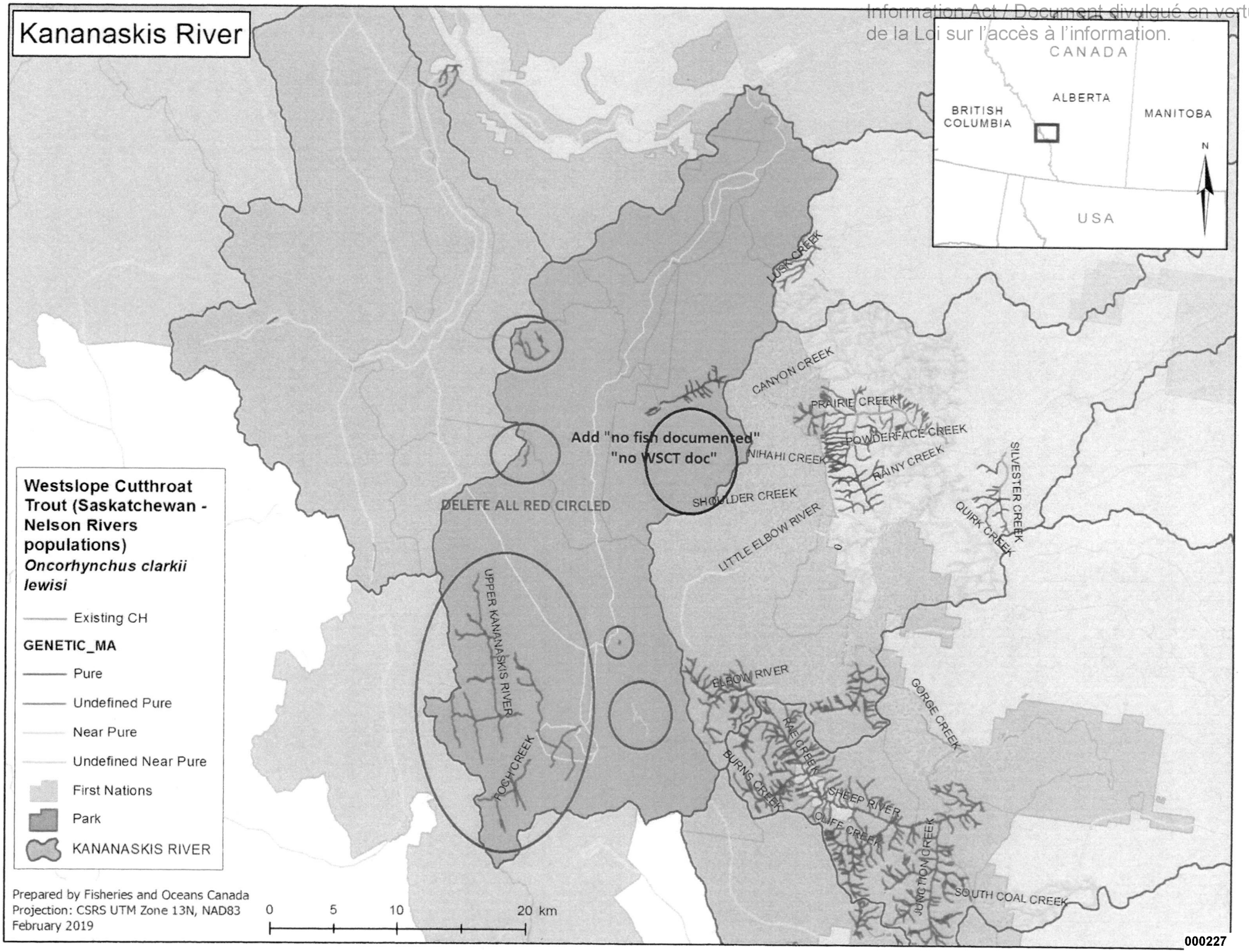




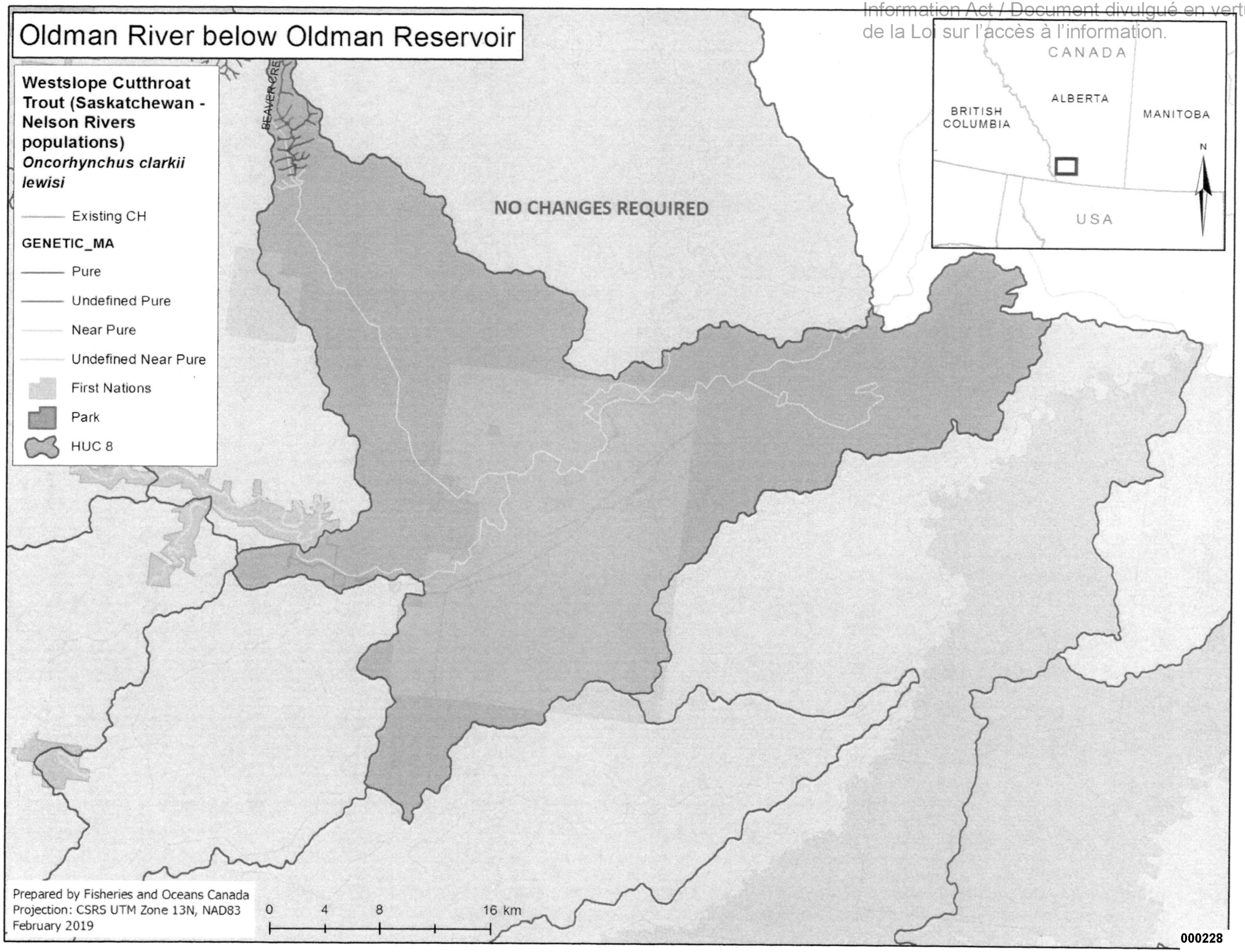
000225

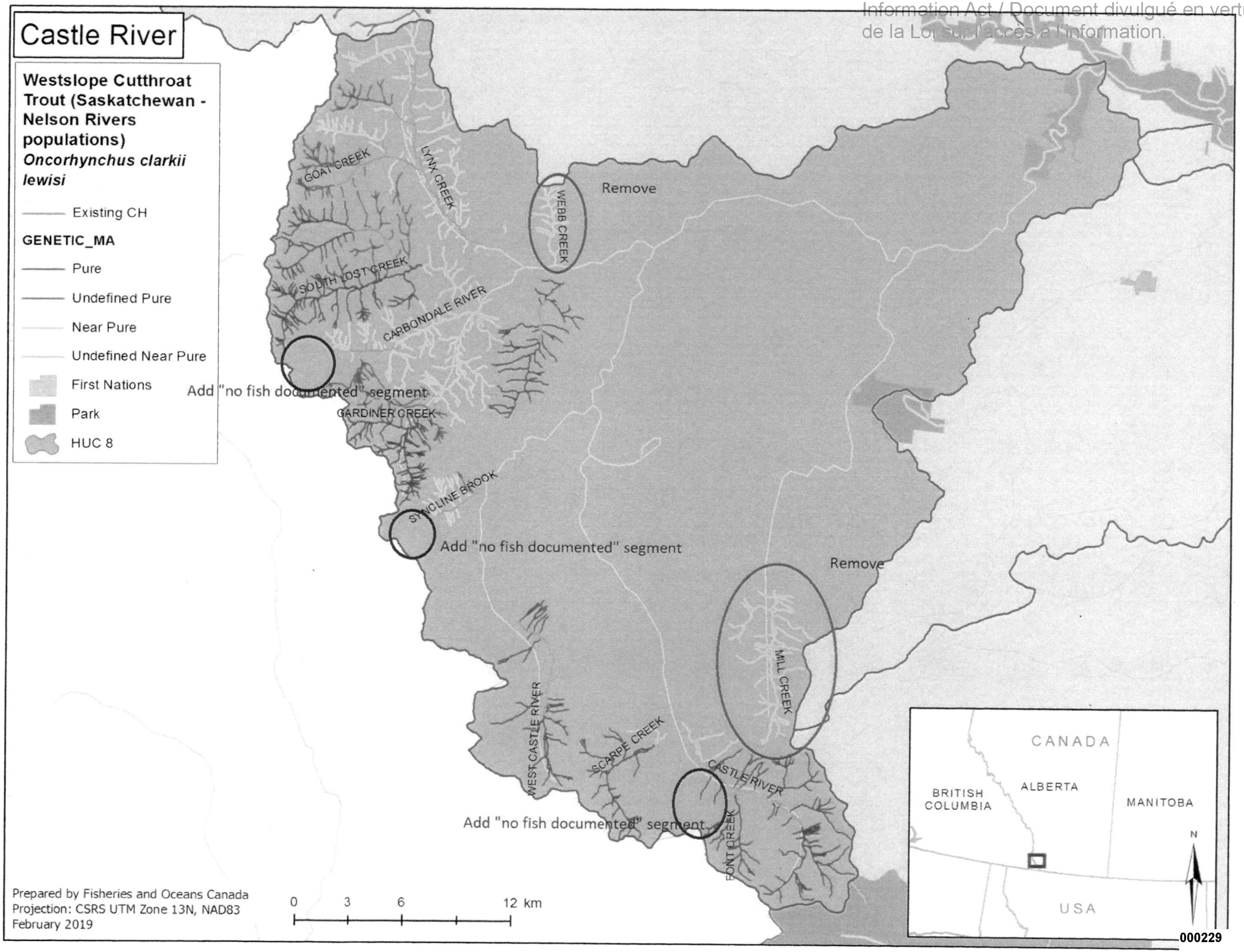


000226

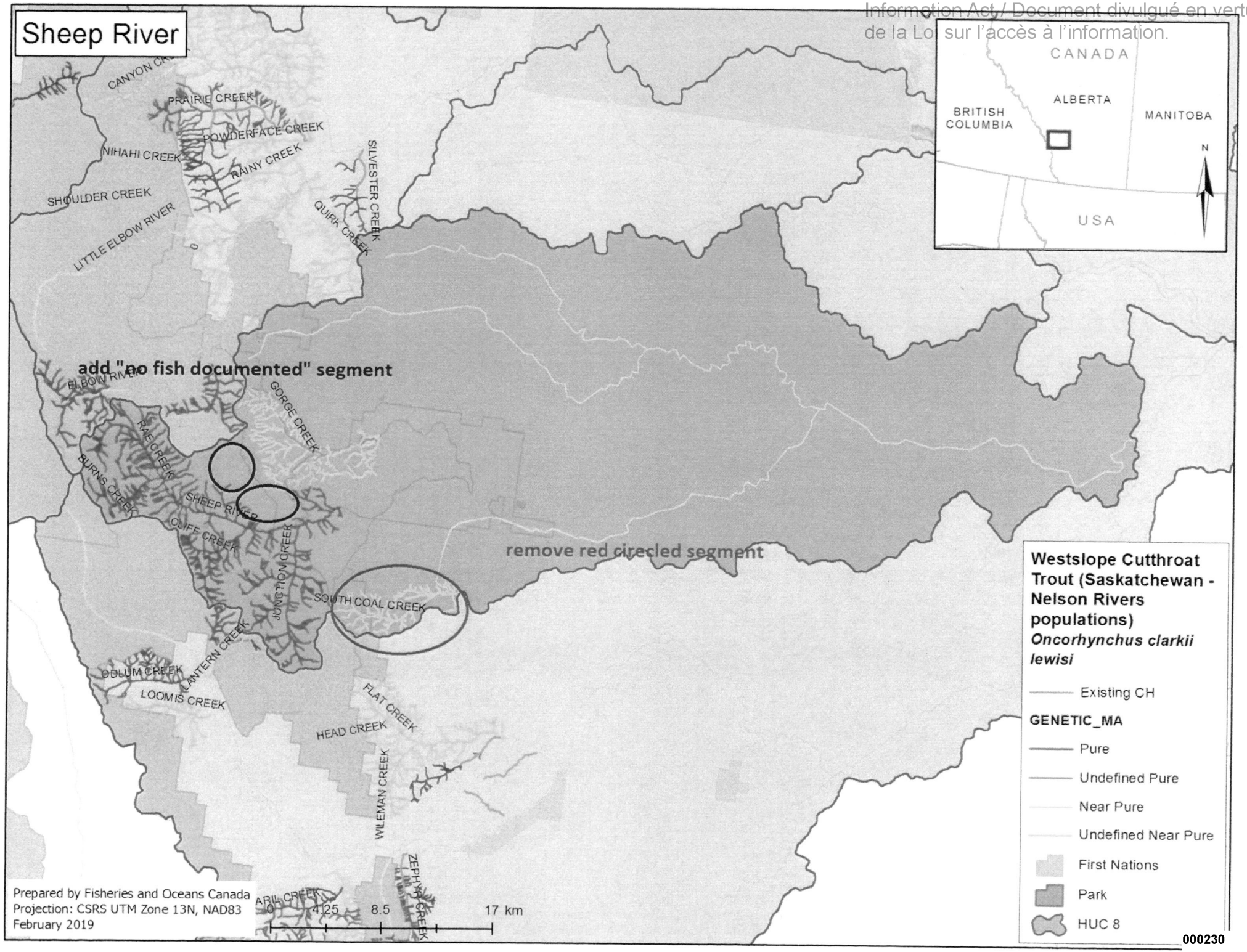


Oldman River below Oldman Reservoir

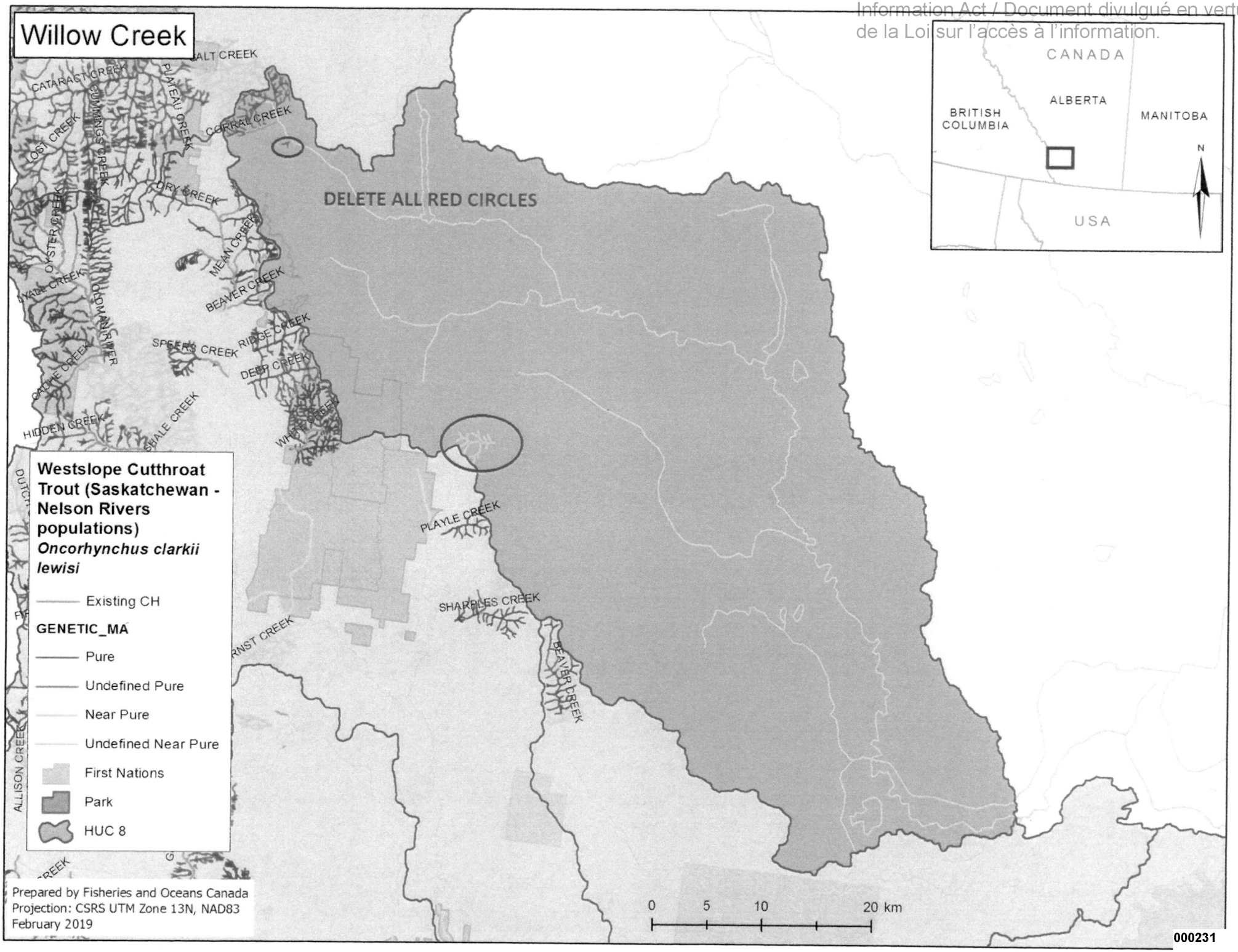




000229



000230



000231

Lacho, Christine

From: Watson, Ernest
Sent: Thursday, February 21, 2019 10:50 AM
To: Doolittle, Andrew
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Yes please. Rename just Ghost River. THANKS!

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Thursday, February 21, 2019 10:49 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Just to quickly confirm – you want the information presented in this map? I will update the shapefiles (and the email below to reflect)

From: Doolittle, Andrew
Sent: February-21-19 11:39 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie – I have put the shapefiles here (117mb!) – not sure if that was the folder you wanted them it or not... anyway, some details on my edits:

1. GDPstreams_Bow – has 5 extra fields on the end:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. OPTION1 – used for a definition query/visibility on the map for the first scenario in the Ghost River watershed
    d. OPTION2 – used for a definition query/visibility on the map for the first scenario in the Ghost River watershed
    e. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
2. GDPstreams_Oldman – has 3 extra fields:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
3. WestslopeCT_CHLinesDFO – has one extra field on the end:
    a. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible). This was used to create the "classification" maps – most of it was visible unless directed to 'mask' it out for the new maps.

I have used https://wetransfer.com/ to send larger files over the internet... might be an option if you wanted to look into it.

Thanks,
Andrew

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-21-19 9:40 AM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

They want them all...

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Thursday, February 21, 2019 8:04 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie – do you just need it for those 3 watersheds?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-20-19 5:36 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: FW: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

??

From: Paul Christensen <Paul.Christensen@gov.ab.ca>
Sent: Wednesday, February 20, 2019 4:31 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Craig Johnson <Craig.Johnson@gov.ab.ca>; Andreas Luek <Andreas.Luek@gov.ab.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie,

Our team is reviewing this as we speak. I'm wondering if you have these available as shapefiles so that our team can do a more thorough review and verify some items?

Thanks

Paul

Paul Christensen
Senior Fisheries Biologist, Bow District
South Saskatchewan Region
Alberta Environment and Parks
Operations Division, Resource Management

#228, 213-1 Street West
Cochrane, AB, T4C 1B4

Phone: 403-851-2149
cell: 403-998-1544
fax: 403-932-2158
email: Paul.Christensen@gov.ab.ca

FWMIS external site at:
FWMIS (Fish & Wildlife Management Information System)

View FWMIS data on-line using the IMF (Internet Mapping Framework)

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 2:21 PM
To: Craig Johnson <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Please note, the following current CH has been proposed for removal based on the ruleset:
HIGHWOOD
-Deep Creek
- Tributary of Flat River

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Watson, Ernest

From: Doolittle, Andrew
Sent: Thursday, February 21, 2019 11:02 AM
To: Watson, Ernest
Cc: Gillespie, Ashley
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie and Ashley – I have put the shapefiles here (117mb!) – not sure if that was the folder you wanted them it or not... anyway, some details on my edits:

1. GDPstreams_Bow – has 3 extra fields on the end:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
2. GDPstreams_Oldman – has 3 extra fields:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
3. WestslopeCT_CHLinesDFO – has one extra field on the end:
    a. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible). This was used to create the "classification" maps – most of it was visible unless directed to 'mask' it out for the new maps.

I have used https://wetransfer.com/ to send larger files over the internet... might be an option if you wanted to look into it.

Thanks,
Andrew

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-21-19 9:40 AM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

They want them all...

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Thursday, February 21, 2019 8:04 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie – do you just need it for those 3 watersheds?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-20-19 5:36 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: FW: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

??

From: Paul Christensen <Paul.Christensen@gov.ab.ca>
Sent: Wednesday, February 20, 2019 4:31 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Craig Johnson <Craig.Johnson@gov.ab.ca>; Andreas Luek <Andreas.Luek@gov.ab.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie,

Our team is reviewing this as we speak. I'm wondering if you have these available as shapefiles so that our team can do a more thorough review and verify some items?

Thanks

Paul

Paul Christensen
Senior Fisheries Biologist, Bow District
South Saskatchewan Region
Alberta Environment and Parks
Operations Division, Resource Management

#228, 213-1 Street West
Cochrane, AB, T4C 1B4

Phone: 403-851-2149
cell: 403-998-1544
fax: 403-932-2158
email: Paul.Christensen@gov.ab.ca

FWMIS external site at:
FWMIS (Fish & Wildlife Management Information System)

View FWMIS data on-line using the IMF (Internet Mapping Framework)

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 2:21 PM
To: Craig Johnson <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Please note, the following current CH has been proposed for removal based on the ruleset:
HIGHWOOD
-Deep Creek
- Tributary of Flat River

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Lacho, Christine

From: Watson, Ernest
Sent: Thursday, February 21, 2019 11:03 AM
To: 'Paul Christensen'
Subject: FW: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Ammended instructions.

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Thursday, February 21, 2019 11:02 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie and Ashley – I have put the shapefiles here (117mb!) – not sure if that was the folder you wanted them it or not... anyway, some details on my edits:

1. GDPstreams_Bow – has 3 extra fields on the end:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
2. GDPstreams_Oldman – has 3 extra fields:
    a. ORIG_CH – I tried to best match the CH extents from the "WestslopeCT_CHLinesDFO" layer
    b. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible)
    c. LEGEND – symbolized using this field - title as shown in the legend (reference to existing field "GENETIC_MA") – streams that were added outside of this attribute were categorized as "Above barrier – no fish documented"
3. WestslopeCT_CHLinesDFO – has one extra field on the end:
    a. KEEP – used for a definition query/visibility on the map (0=not visible, 1= visible). This was used to create the "classification" maps – most of it was visible unless directed to 'mask' it out for the new maps.

I have used https://wetransfer.com/ to send larger files over the internet... might be an option if you wanted to look into it.

Thanks,
Andrew

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-21-19 9:40 AM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

They want them all...

From: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Sent: Thursday, February 21, 2019 8:04 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie – do you just need it for those 3 watersheds?

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: February-20-19 5:36 PM
To: Doolittle, Andrew <Andrew.Doolittle@dfo-mpo.gc.ca>
Subject: FW: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

??

From: Paul Christensen <Paul.Christensen@gov.ab.ca>
Sent: Wednesday, February 20, 2019 4:31 PM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Cc: Craig Johnson <Craig.Johnson@gov.ab.ca>; Andreas Luek <Andreas.Luek@gov.ab.ca>
Subject: RE: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Hi Ernie,

Our team is reviewing this as we speak. I'm wondering if you have these available as shapefiles so that our team can do a more thorough review and verify some items?

Thanks

Paul

Paul Christensen
Senior Fisheries Biologist, Bow District
South Saskatchewan Region
Alberta Environment and Parks
Operations Division, Resource Management

#228, 213-1 Street West
Cochrane, AB, T4C 1B4

Phone: 403-851-2149
cell: 403-998-1544
fax: 403-932-2158
email: Paul.Christensen@gov.ab.ca

FWMIS external site at:
FWMIS (Fish & Wildlife Management Information System)

View FWMIS data on-line using the IMF (Internet Mapping Framework)

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 2:21 PM
To: Craig Johnson <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>;

diane.casimir@pc.gc.ca
Subject: WSCT RS/AP - DRAFT CH - 2 of 4 (JUMPINGPOUND / GHOST / HIGHWOOD)

Please note, the following current CH has been proposed for removal based on the ruleset:
HIGHWOOD
-Deep Creek
- Tributary of Flat River

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Lacho, Christine

From: Paul Christensen <Paul.Christensen@gov.ab.ca>
Sent: Thursday, February 21, 2019 5:31 PM
To: Watson, Ernest
Cc: Andreas Luek; Craig Johnson
Subject: RE: FOR ACTION: Proposed Critical Habitat, Westslope Cutthroat Trout Recovery Strategy – Action Plan

Importance: High

Hi Ernie,

Thanks for the opportunity to review these initial maps, and for providing your ruleset to describe the process for designating potential Critical Habitat (CH). Generally speaking, our comments are as follows:

- The rule set appears to be a rational approach to protecting habitat in Pure WSCT streams, and provides a positive path forward to protecting habitat in streams containing Near Pure WSCT (in High Certainty areas)
- For your awareness, the team noted some areas of discrepancy between the proposed rule set and the proposed CH. The categorical examples generally include:
    - Not including some streams defined as Pure- Low Certainty for consideration as CH
    - Some streams were included as proposed CH that were defined as Near Pure-Low Certainty
    - Some areas that were defined as fishless, above Pure areas, were not included as CH

Thanks for the opportunity to comment on these maps, and if you have any additional questions about our review, please don't hesitate to contact me.

Paul

Paul Christensen
Senior Fisheries Biologist, Bow District
South Saskatchewan Region
Alberta Environment and Parks
Operations Division, Resource Management

#228, 213-1 Street West
Cochrane, AB. T4C 1B4

Phone: 403-851-2149
cell: 403-998-1544
fax: 403-932-2158
email: Paul.Christensen@gov.ab.ca

FWMIS external site at:
FWMIS (Fish & Wildlife Management Information System)

View FWMIS data on-line using the IMF (Internet Mapping Framework)

From: Craig Johnson <Craig.Johnson@gov.ab.ca>
Sent: Wednesday, February 20, 2019 2:42 PM
To: Paul Christensen <Paul.Christensen@gov.ab.ca>; Andreas Luek <Andreas.Luek@gov.ab.ca>; Shane Petry <shane.petry@gov.ab.ca>

Subject: FW: FOR ACTION: Proposed Critical Habitat, Westslope Cutthroat Trout Recovery Strategy – Action Plan
Importance: High

Paul, Andreas, (and Shane if you want to...),

This is a priority to complete by tomorrow...urgent...

Take a look at Ernie's request below and:

- Assess how we should best review these draft CH maps with our team – who should this be assigned to?
- How do we ensure that our review in the region is consistent?
- Who will coordinate our regional response back to DFO on behalf of our team?

I have inquired with Sue to have her coordinate the review with the Policy staff...Dani, David J., and Pat. You don't need to do this.

The maps are in the emails attached. Let me know if you have any questions...thanks...cj

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Wednesday, February 20, 2019 2:19 PM
To: Craig Johnson <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>; diane.casimir@pc.gc.ca
Subject: FOR ACTION: Proposed Critical Habitat, Westslope Cutthroat Trout Recovery Strategy – Action Plan

Hello All:

Please find over the next few emails initial draft maps for proposed extent of critical habitat to be in the Recovery Strategy-Action Plan.

Identification of Critical Habitat

These draft Critical Habitat segments were based, in part, on the draft AEP Genetic Delineation shape files and the "Draft Alberta Westslope Cutthroat Trout Genetic Delineation Project Mapping Rule Set".

In general, the following rule set to identify a segment of Draft Critical Habitat:

1. Pure - High Confidence segments (P-HC)
    a. SNP tested point upstream, ≥16 fish sampled.
    b. SNP tested point downstream to permanent barrier, <16 fish sampled.
2. Pure - Low Confidence (P-LC) Pure segments
    a. SNP or MS tested point upstream, ≥16 fish sampled.
    b. SNP or MS tested point downstream to permanent barrier, <16 fish sampled.
    c. Segments where WSCT are present, no genetic information exists, and
        i. they are suspected pure
        ii. upstream of a permanent barrier
    d. Segments where WSCT or all fish species presence is unknown
        i. they are suspected present, and pure
        ii. upstream of a permanent barrier
3. Near Pure - High Confidence Near Pure
    a. Near Pure - High Confidence segments that are contiguous with upstream Pure - High Confidence segments (based of potential for recovery and the precautionary principle)

4. Areas of Critical Habitat identified in Recovery Strategy (2014)
    a. If previous CH and remains High or Low confidence Pure: keep and extend to tributaries upstream
    b. If previous Critical Habitat stream segments are now High or Low confidence Pure, segments will be extended and their tributaries will be included as Critical Habitat (based of potential for recovery and the precautionary principle)
5. "All Fish Species Status Unknown" upstream of Critical Habitat segments (rules 1-4) (ecological integrity and precautionary principle)

Maps

You will be forwarded 2 maps for each of the 11 HUC 8s where Critical Habitat has been identified:

1. Map titled "HUC_Classification": Map with GDP classification and extent of current Critical Habitat
2. Map titled "HUC_ProposedCH": Map with proposed Critical Habitat

If you could conduct a review of the rule set and maps and provide the following:

- Feedback regarding the soundness of the proposed rule set for determining Critical Habitat
- Identify any major challenges or issues regarding the proposed extent of Critical Habitat to be included in the proposed Recovery Strategy–Action Plan

We are asking for your feedback by Friday morning. If you have no major challenges or issues have been identified, we are asking for your endorsement of the proposed extent of Critical Habitat to be included in the proposed Recovery Strategy – Action Plan.

We appreciate your attention to this matter,

Ernie.

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>

Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril

Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Lacho, Christine

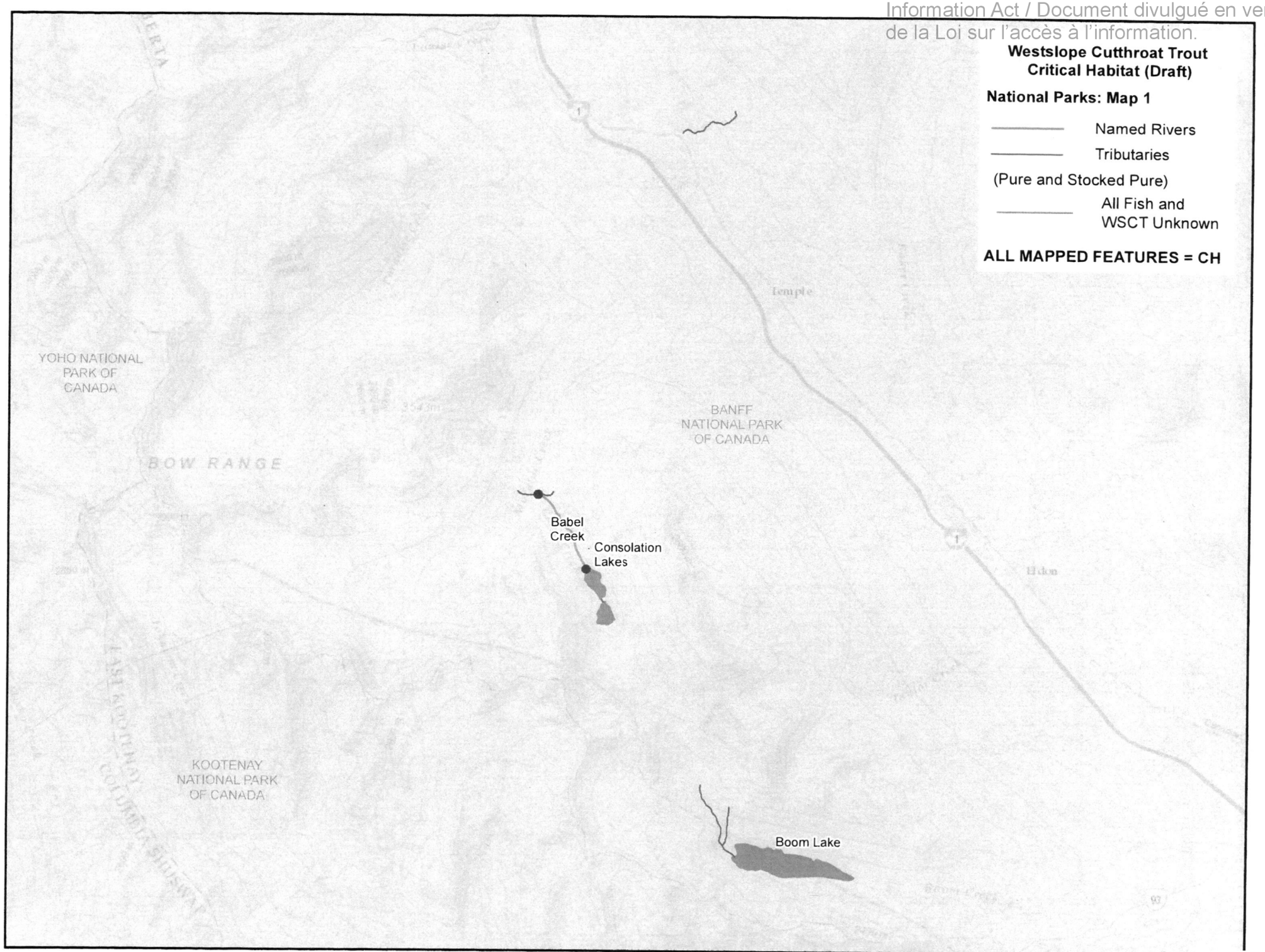
From: Watson, Ernest
Sent: Friday, February 22, 2019 9:03 AM
To: Geraghty, Andrew
Subject: FW: For CH mapping/data
Attachments: NationalParks_Mar2018.pdf; CH Start End Pts.xlsx

From: Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Sent: Friday, February 22, 2019 8:59 AM
To: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Subject: For CH mapping/data

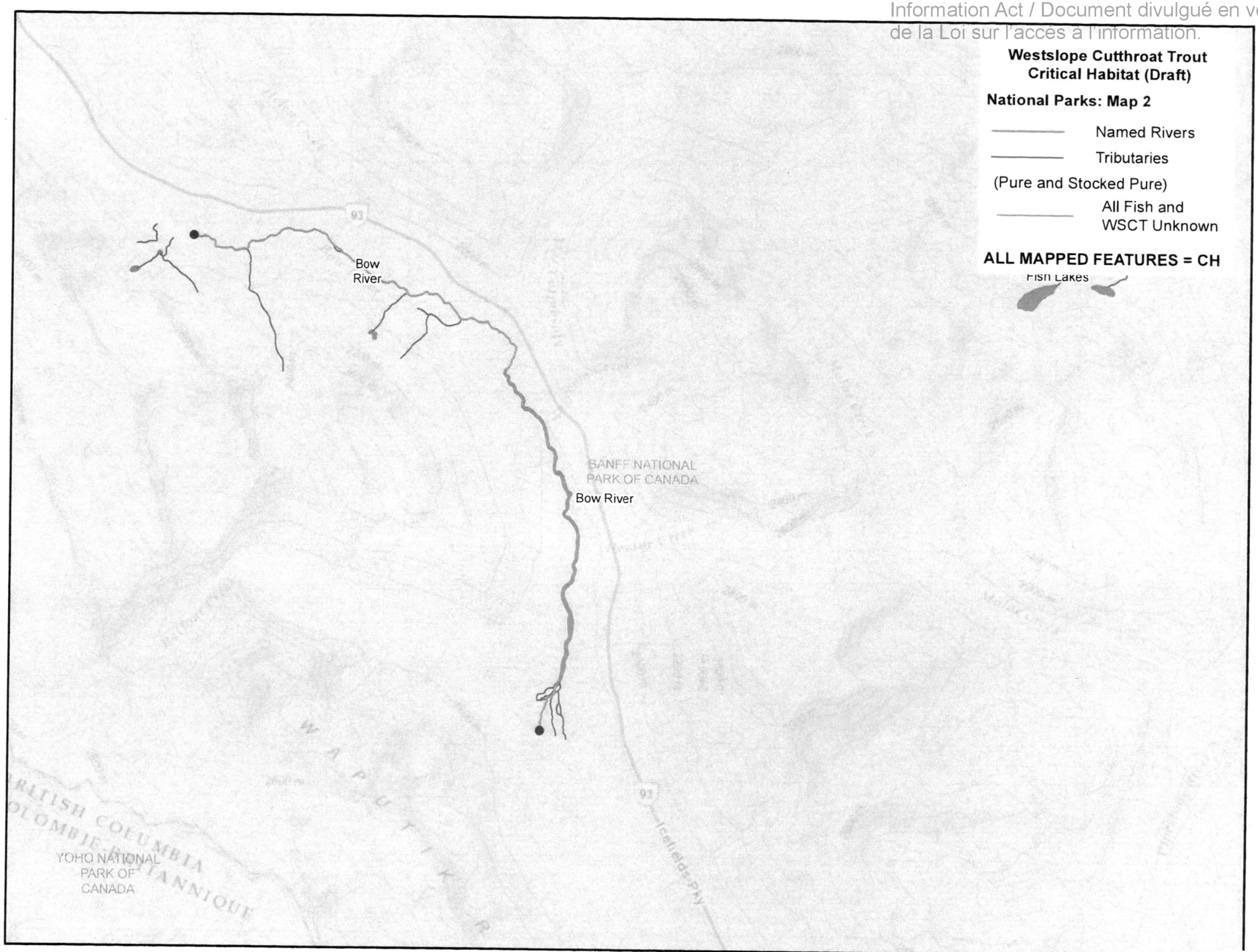
Here's the maps that Carolyn produced for the CH in National Parks. I can do a search through my email to see if I can find it, but it might be easier to check with Carolyn to see if she still has it saved somewhere.

I've also included an excel spreadsheet for the start/end points of CH that is needed for the recovery strategy-action plan. I've broken it down into National Parks (Banff) lakes and flowing waters, and then areas outside of national parks (the rest of AB) lakes and flowing waters. We will just need the named waterbodies listed in the start and end points, unless there is a unnamed tributary that is CH and not connected to a named CH waterbody. I think the unnamed tributary to Rock Creek (pure high confidence) is an example of this, where the tributary will be CH and Rock Creek itself is hybrid (not CH).

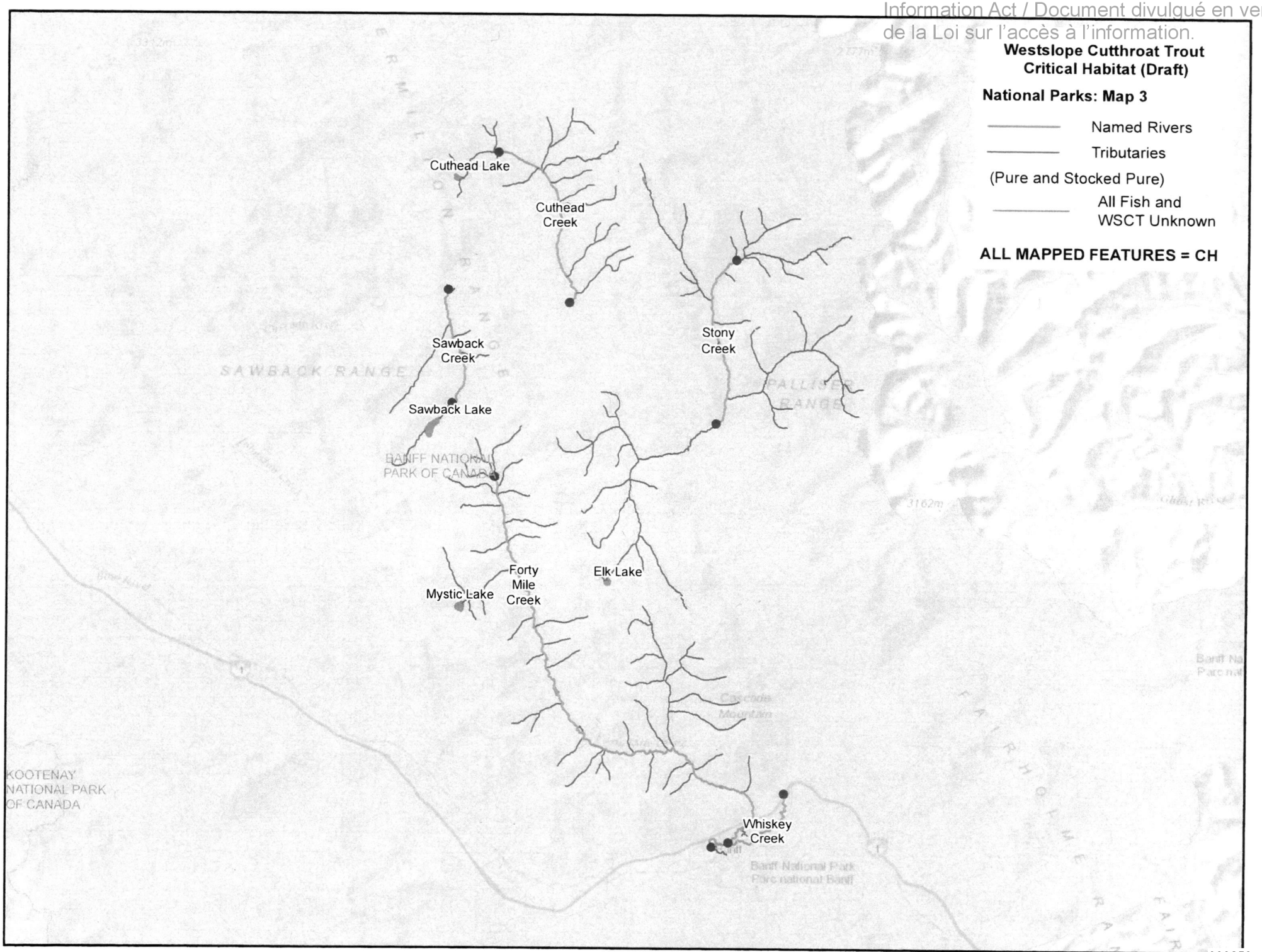
Waterbody Name	Upstream Latitude	Upstream Longitude



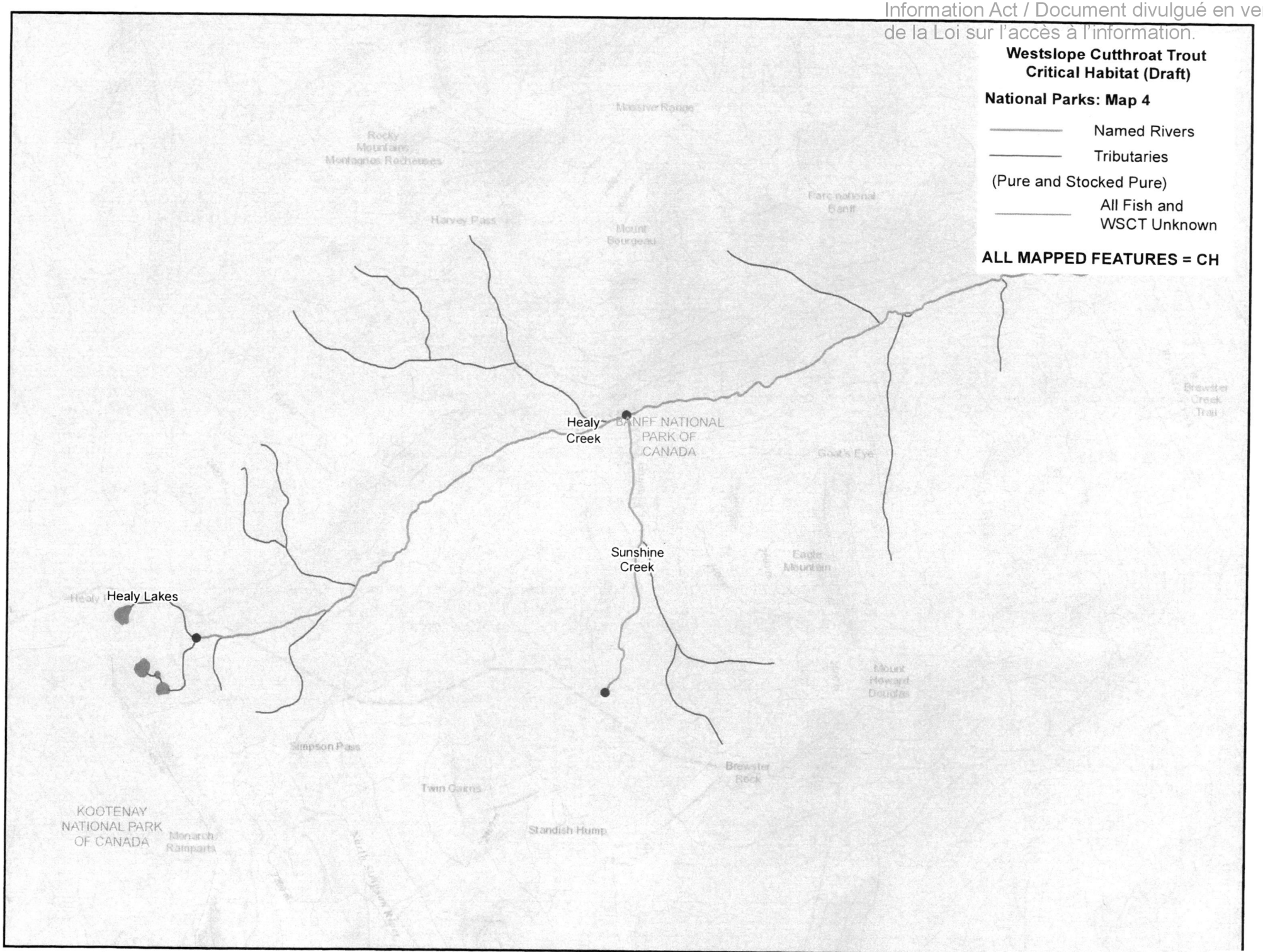
22/03/2018



22/03/2018

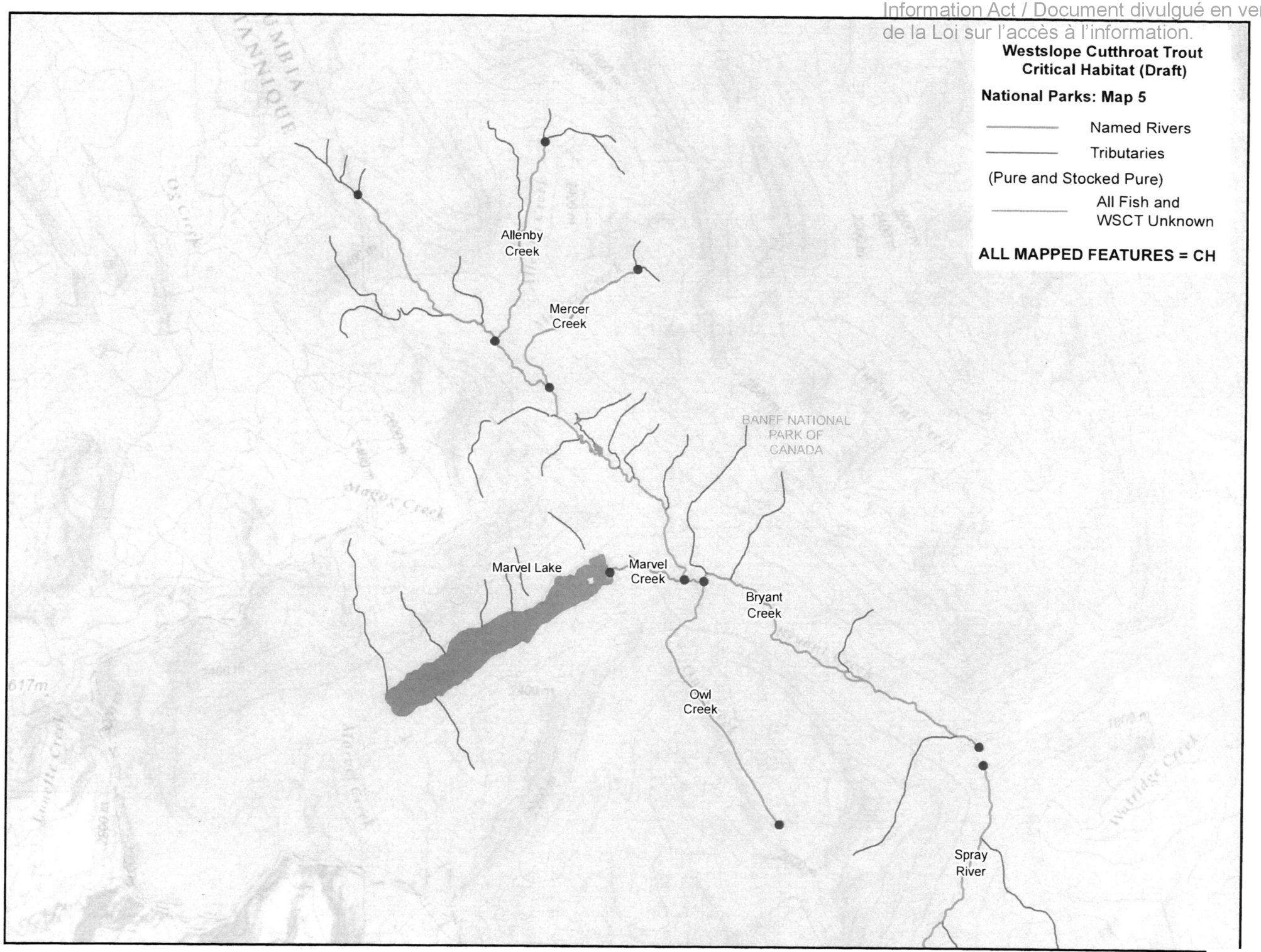


22/03/2018

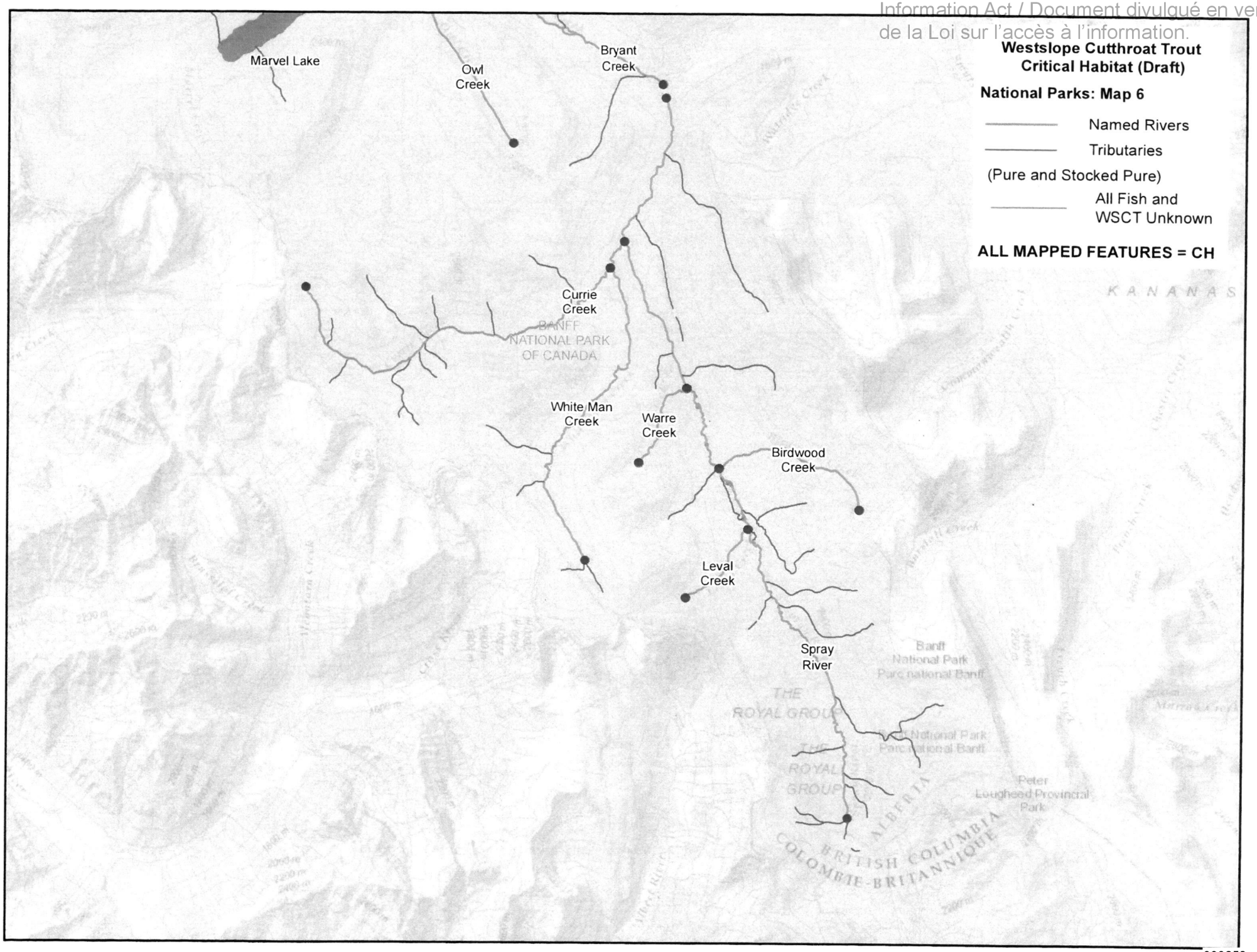


000251

22/03/2018



22/03/2018



Westslope Cutthroat Trout Critical Habitat (Draft)

National Parks: Map 6

Named Rivers

Tributaries

(Pure and Stocked Pure)

All Fish and WSCT Unknown

ALL MAPPED FEATURES = CH

22/03/2018

000253

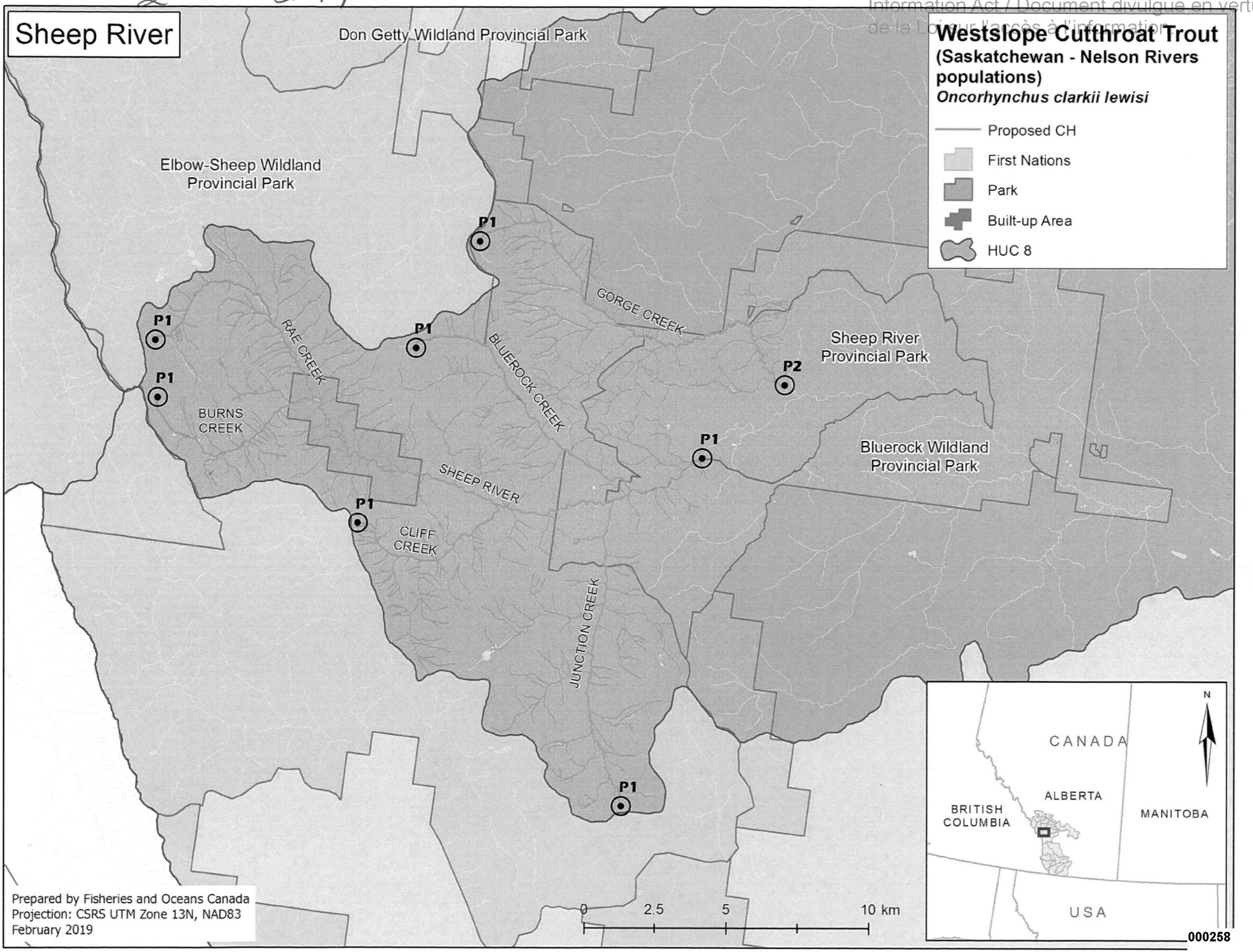
Waterbody Name	Latitude	Longitude

Waterbody Name	Upstream Latitude	Upstream Longitude	Downstream Latitude

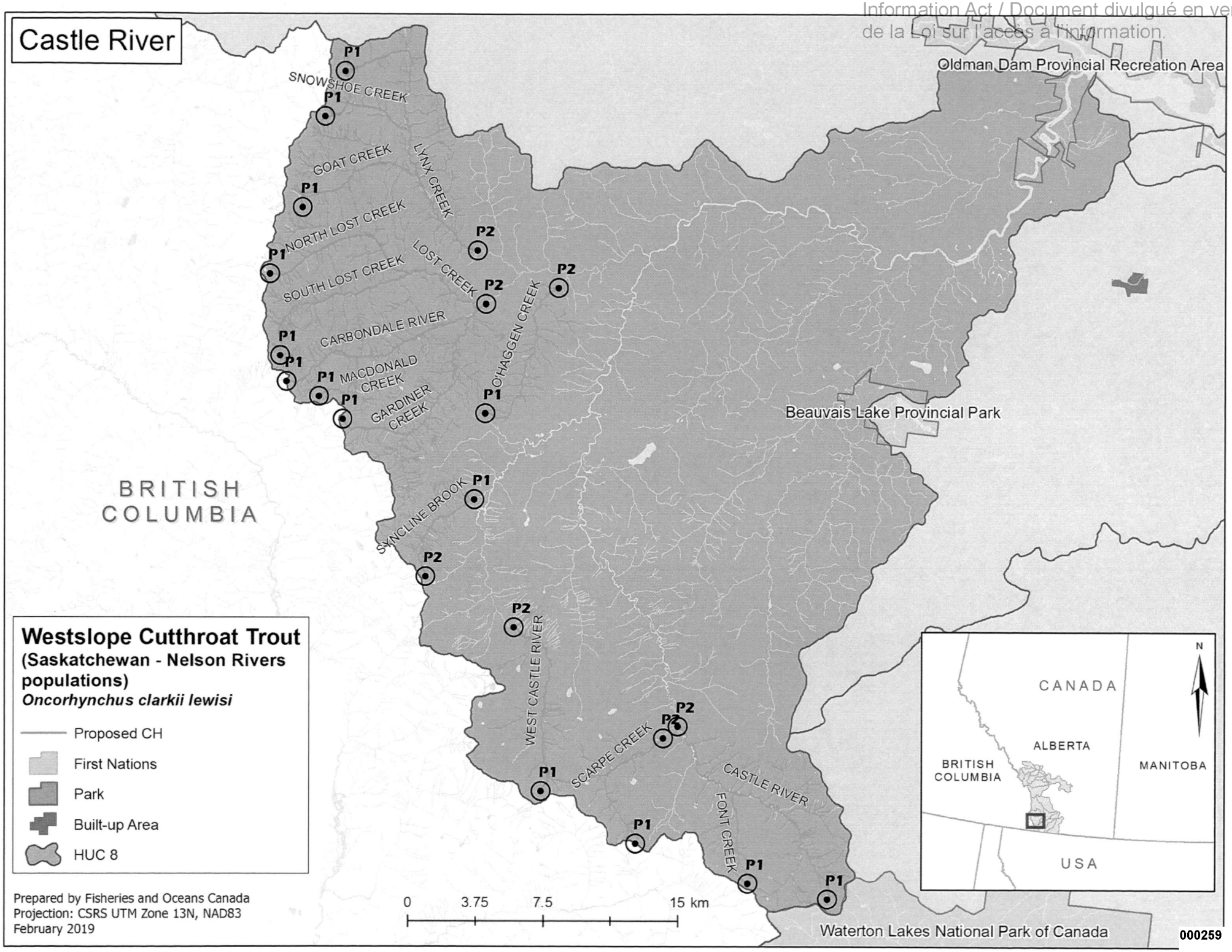
Waterbody Name	Latitude	Longitude

Downstream Latitude	Downstream Longitude

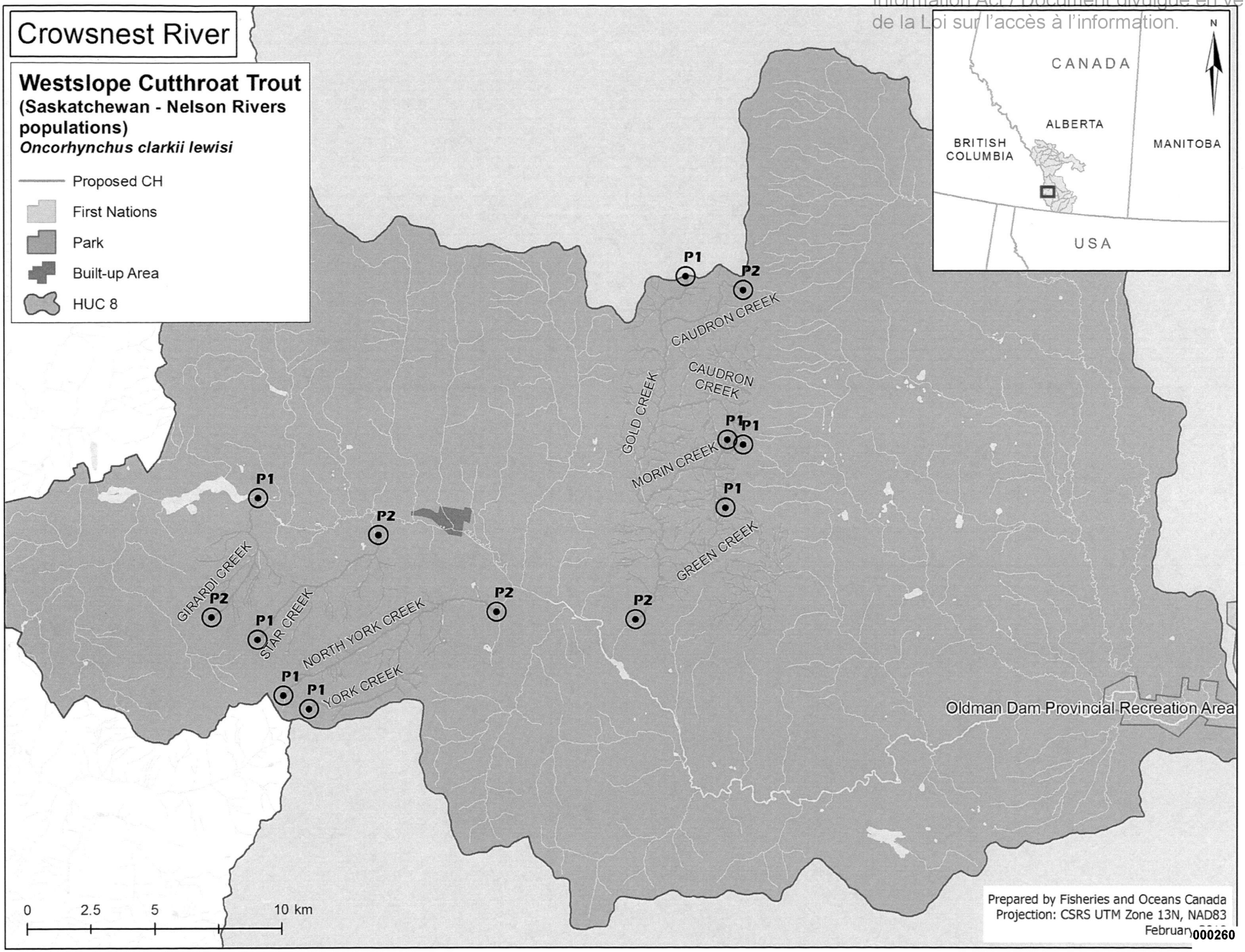
2-27-2019

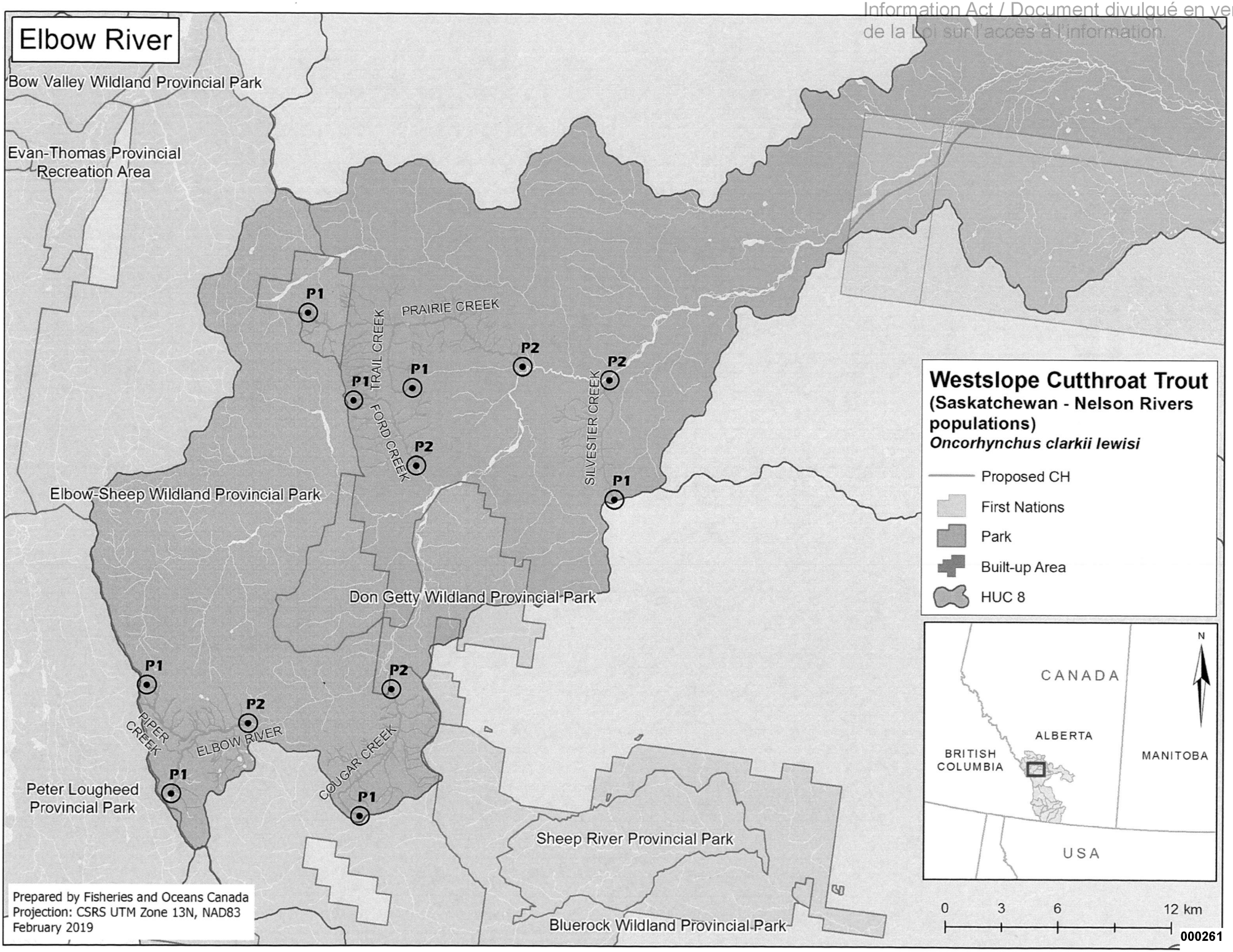


000258

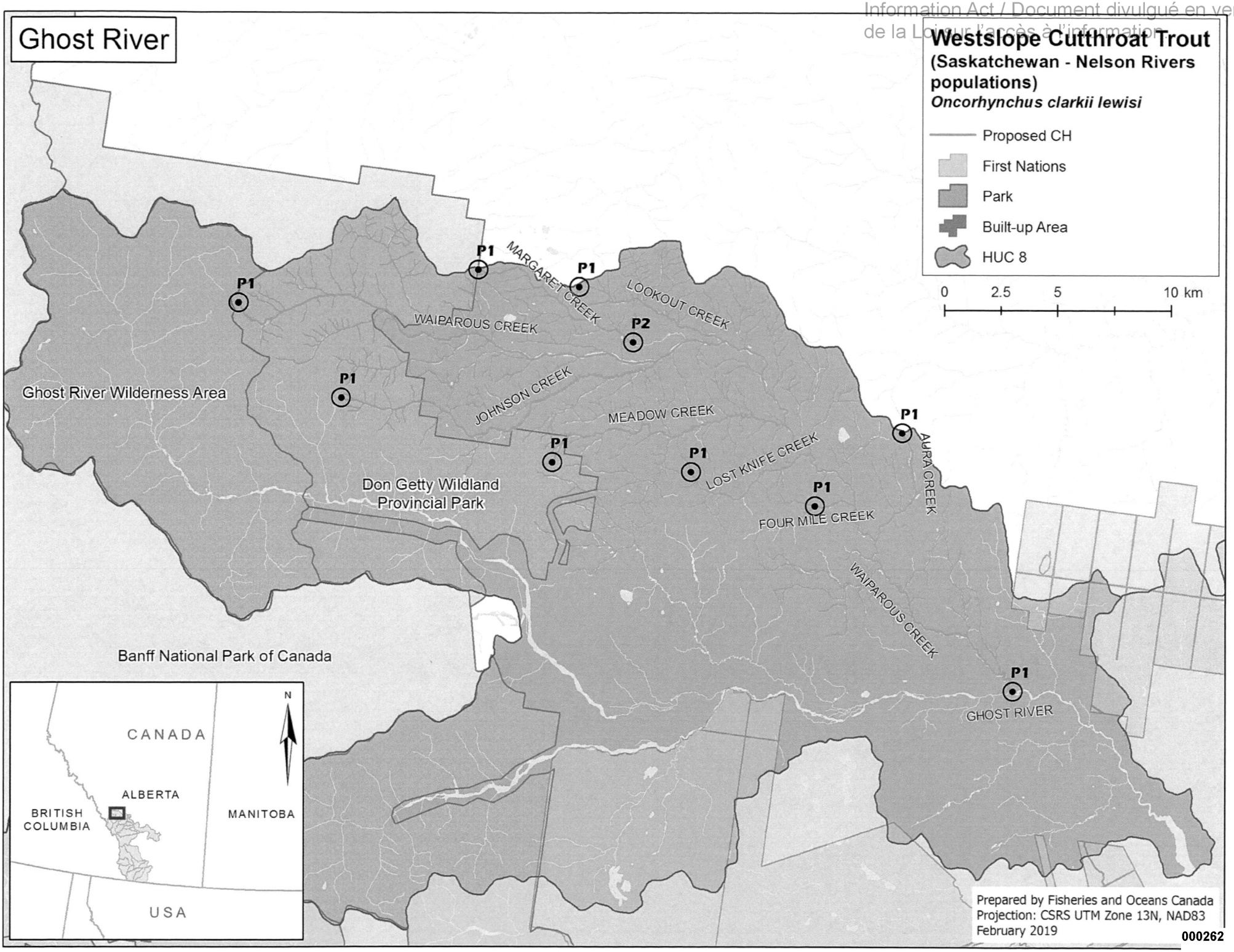


000259

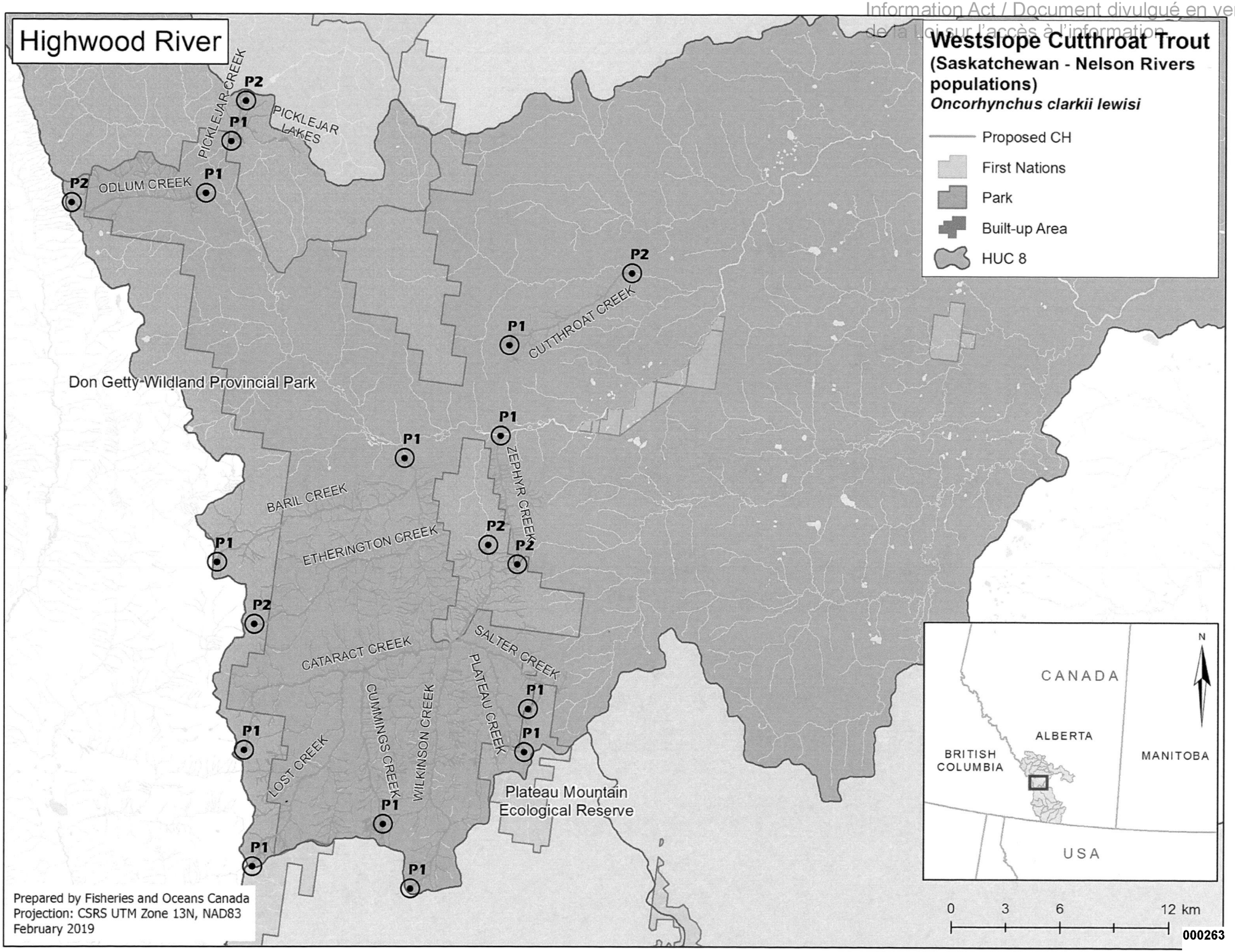




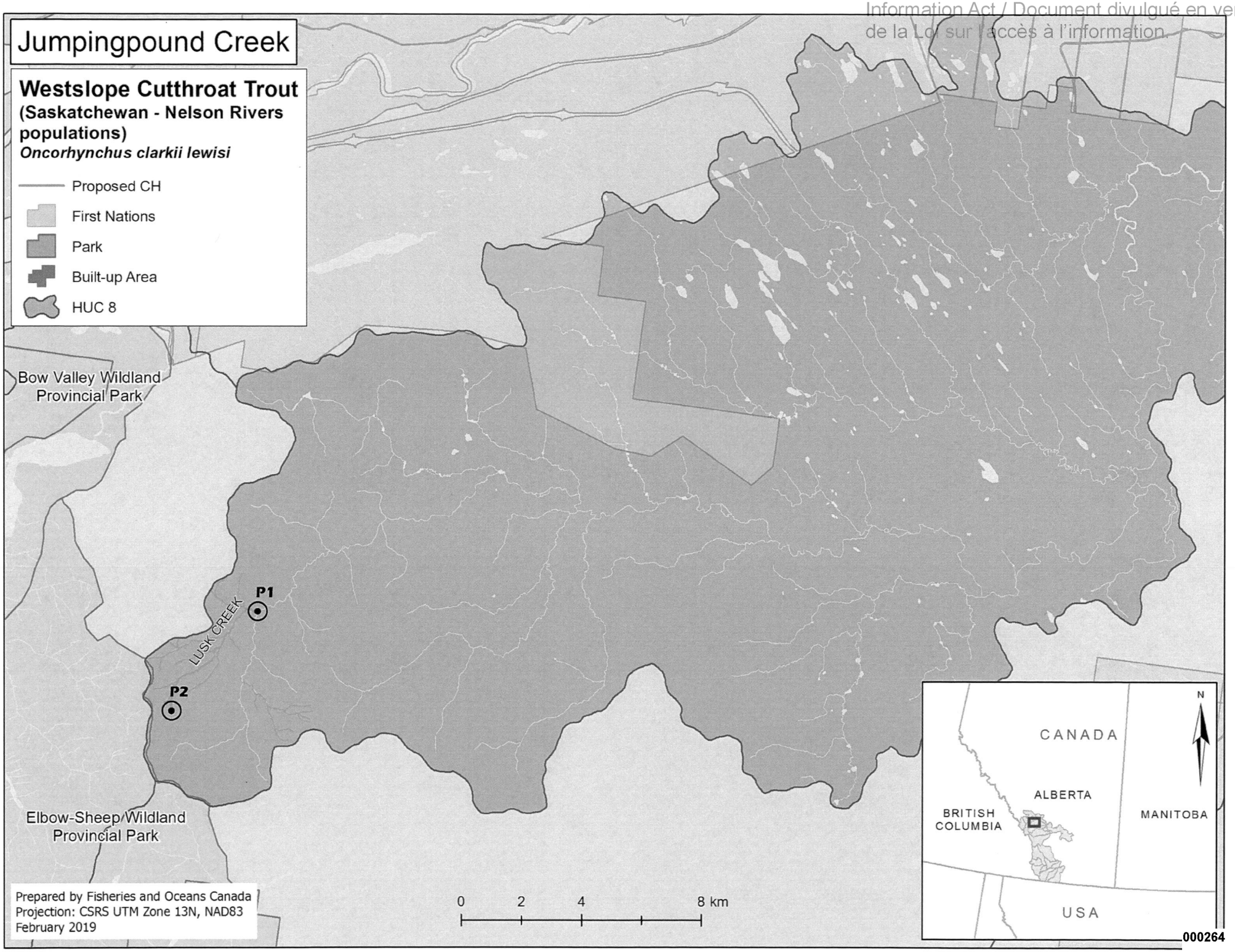
000261

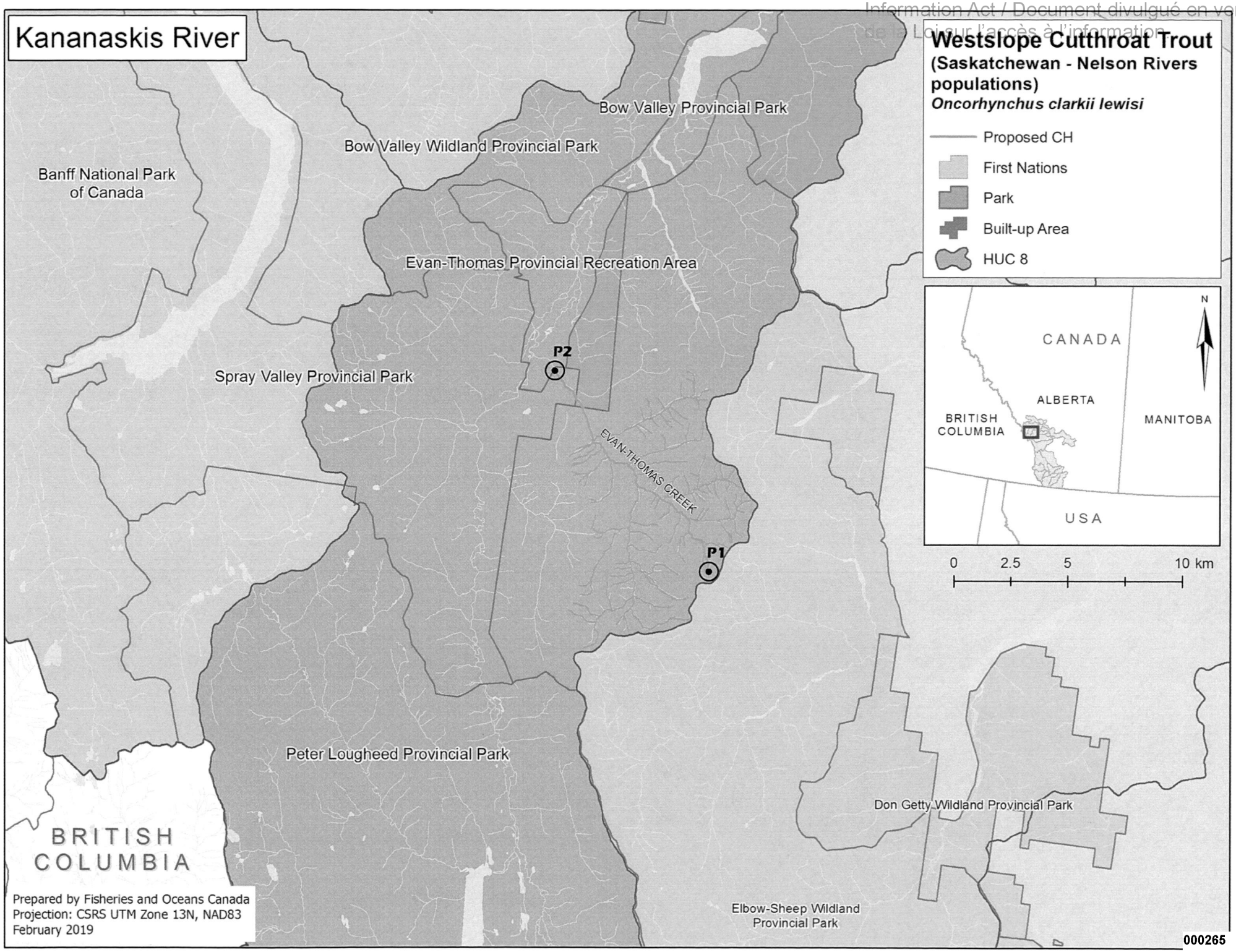


000262

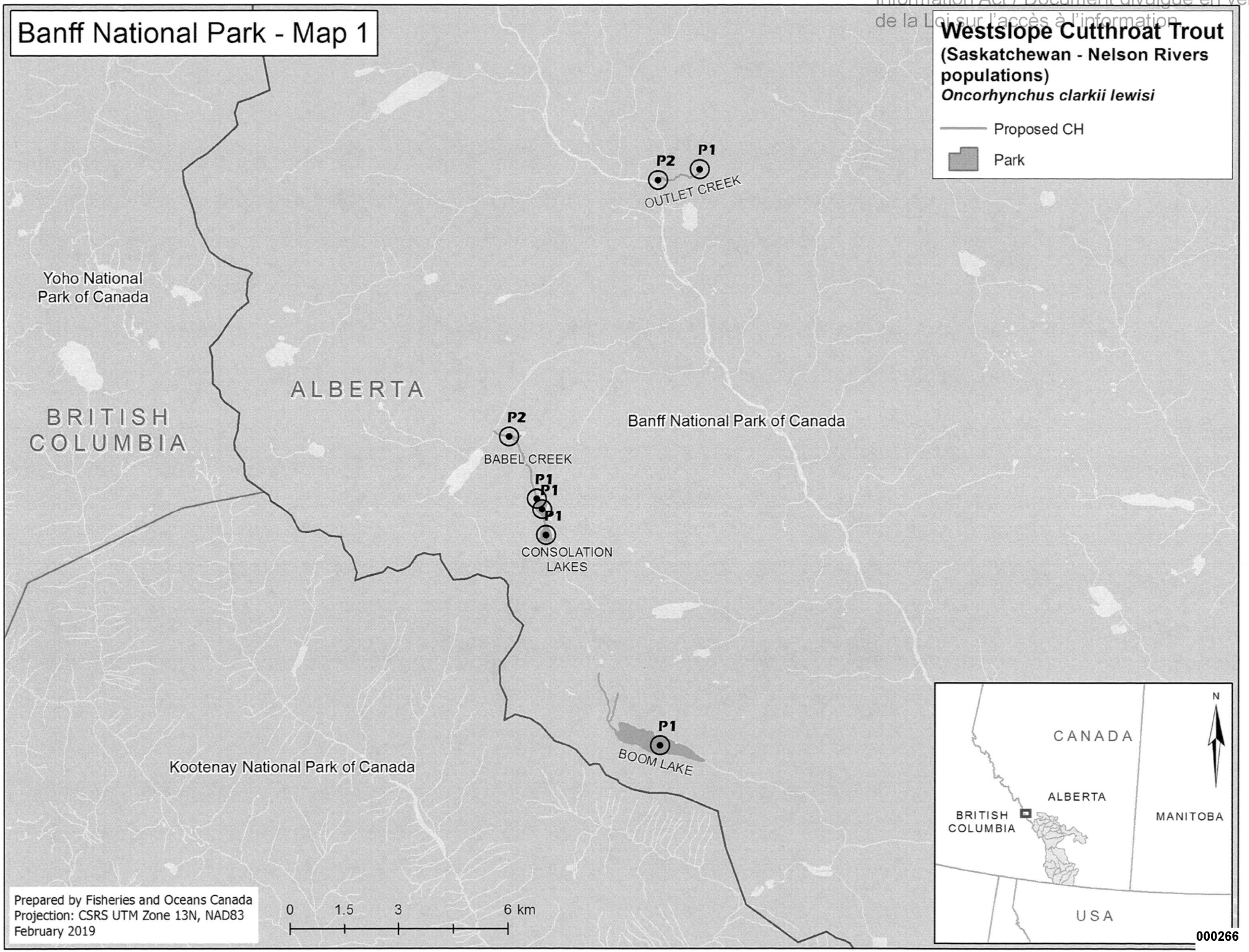


000263

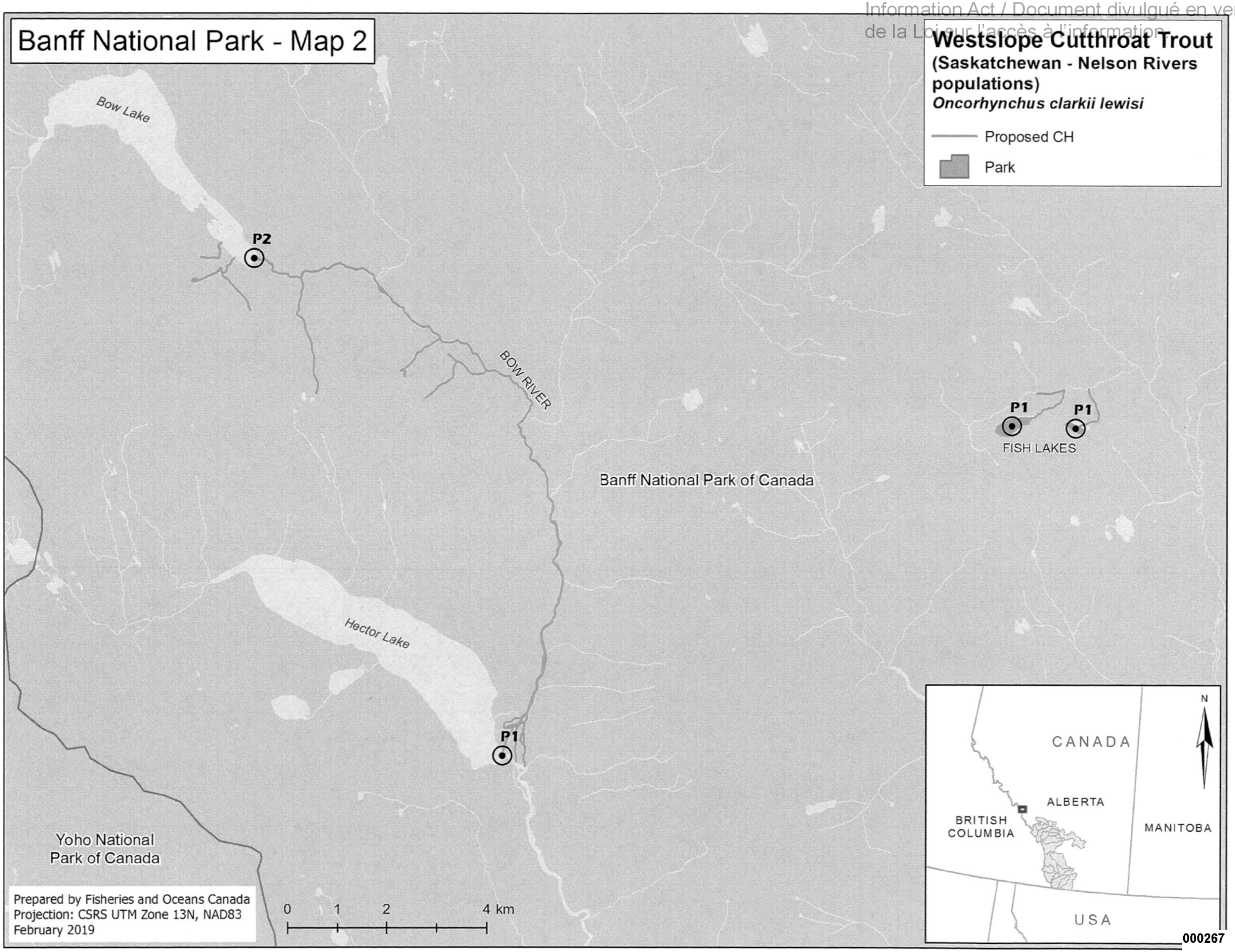




000265



000266



000267

Banff National Park - Map 3

Westslope Cutthroat Trout
(Saskatchewan - Nelson Rivers populations)
Oncorhynchus clarkii lewisi

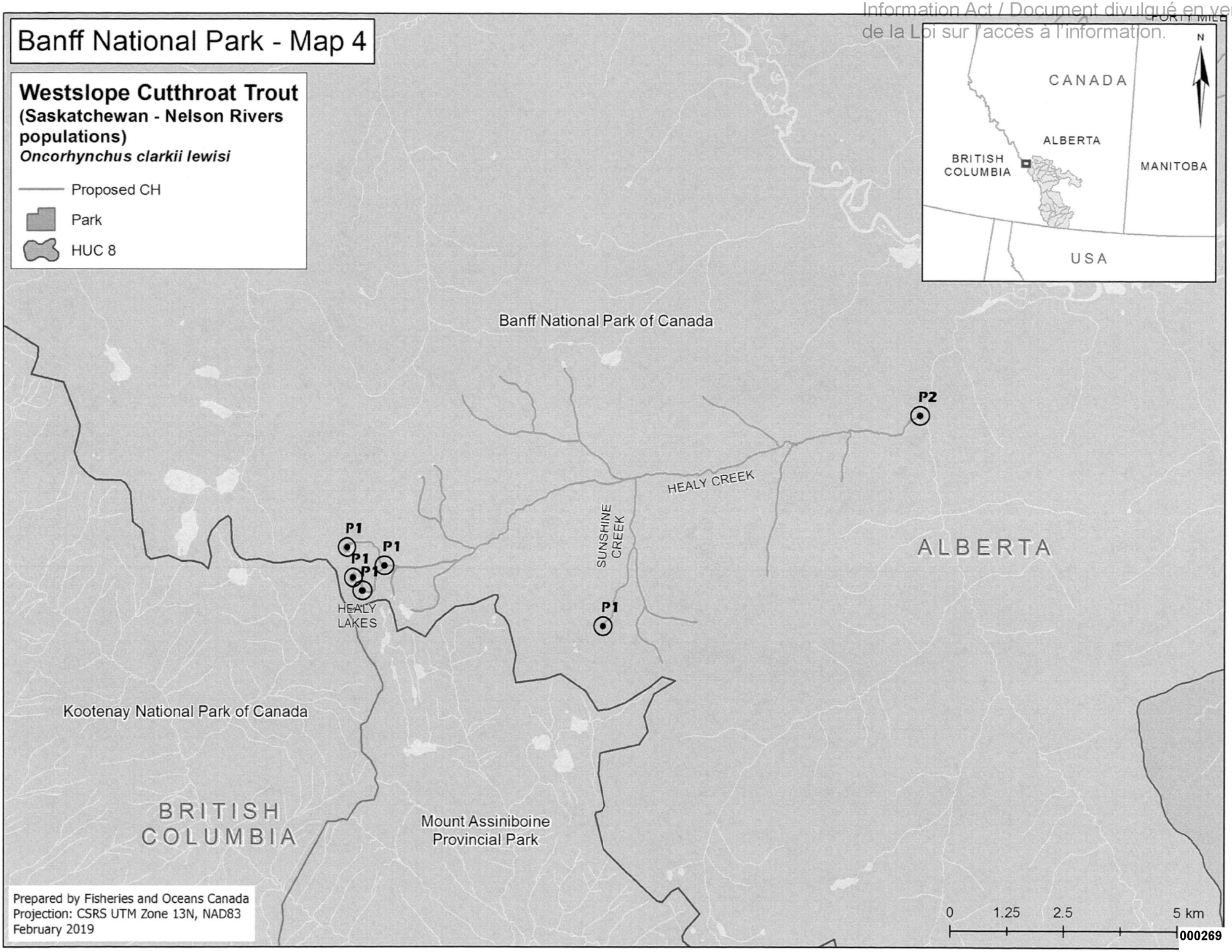
Proposed CH
Park
HUC 8

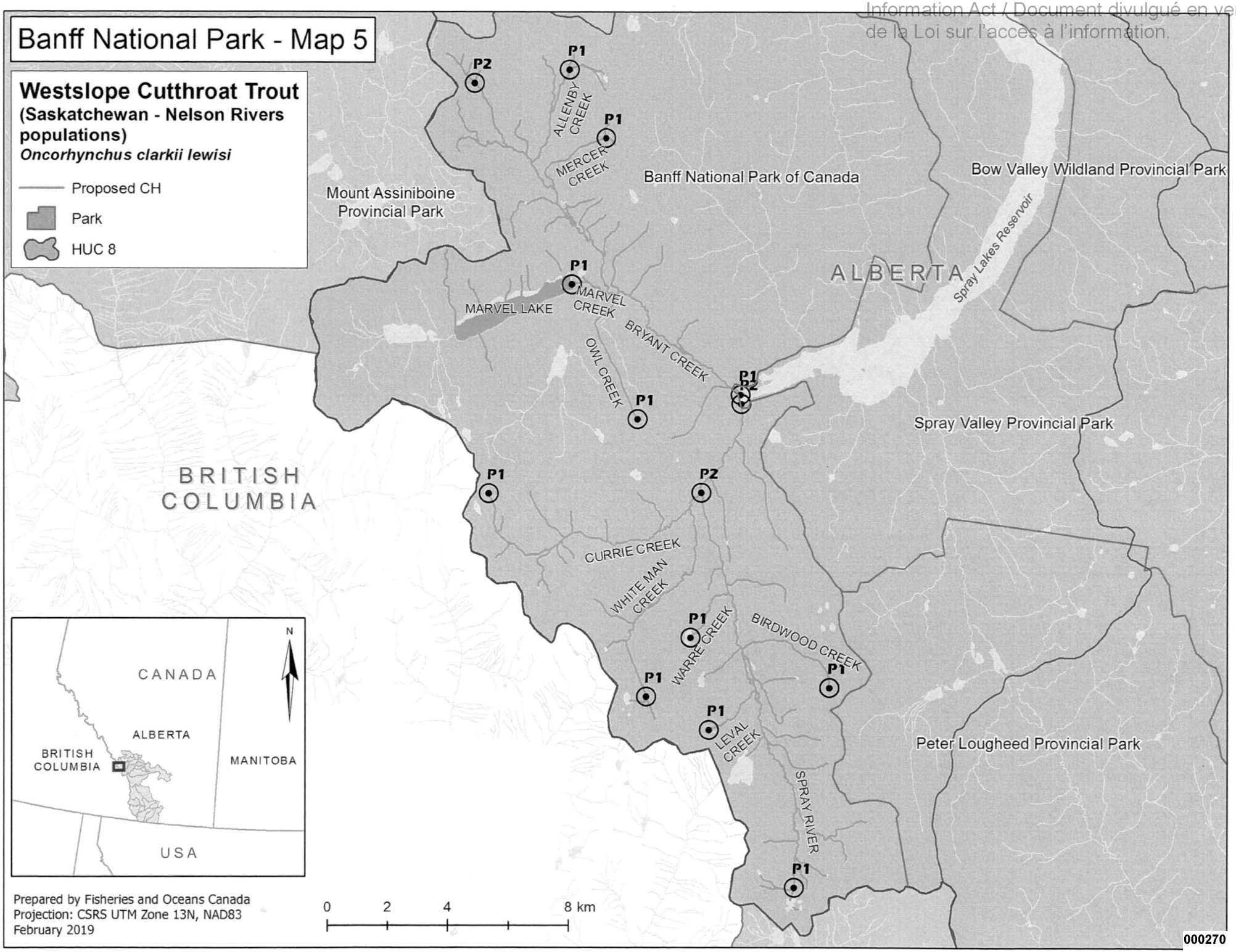
0 2.5 5 10 km

P1 CUTHEAD CREEK
P2
P2 SAWBACK CREEK
P1
P1 SAWBACK LAKE
P2
P1 STONY CREEK
P2
Banff National Park of Canada
Ghost River Wilderness Area
Don Getty Wildland Provincial Park
P1 MYSTIC LAKE
P1 ELK LAKE
FORTY MILE CREEK
P1
P1 WHISKEY CREEK

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

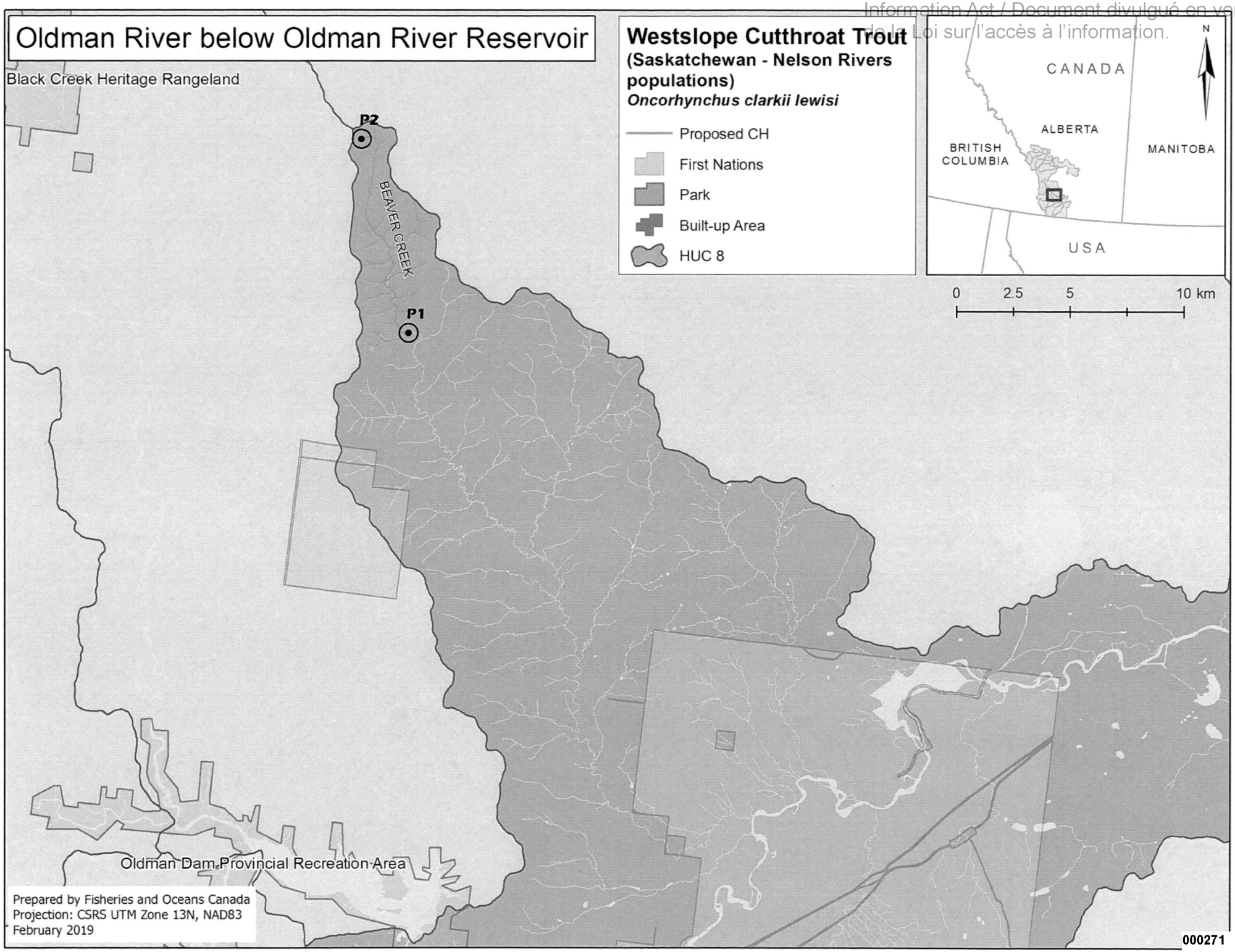
000268



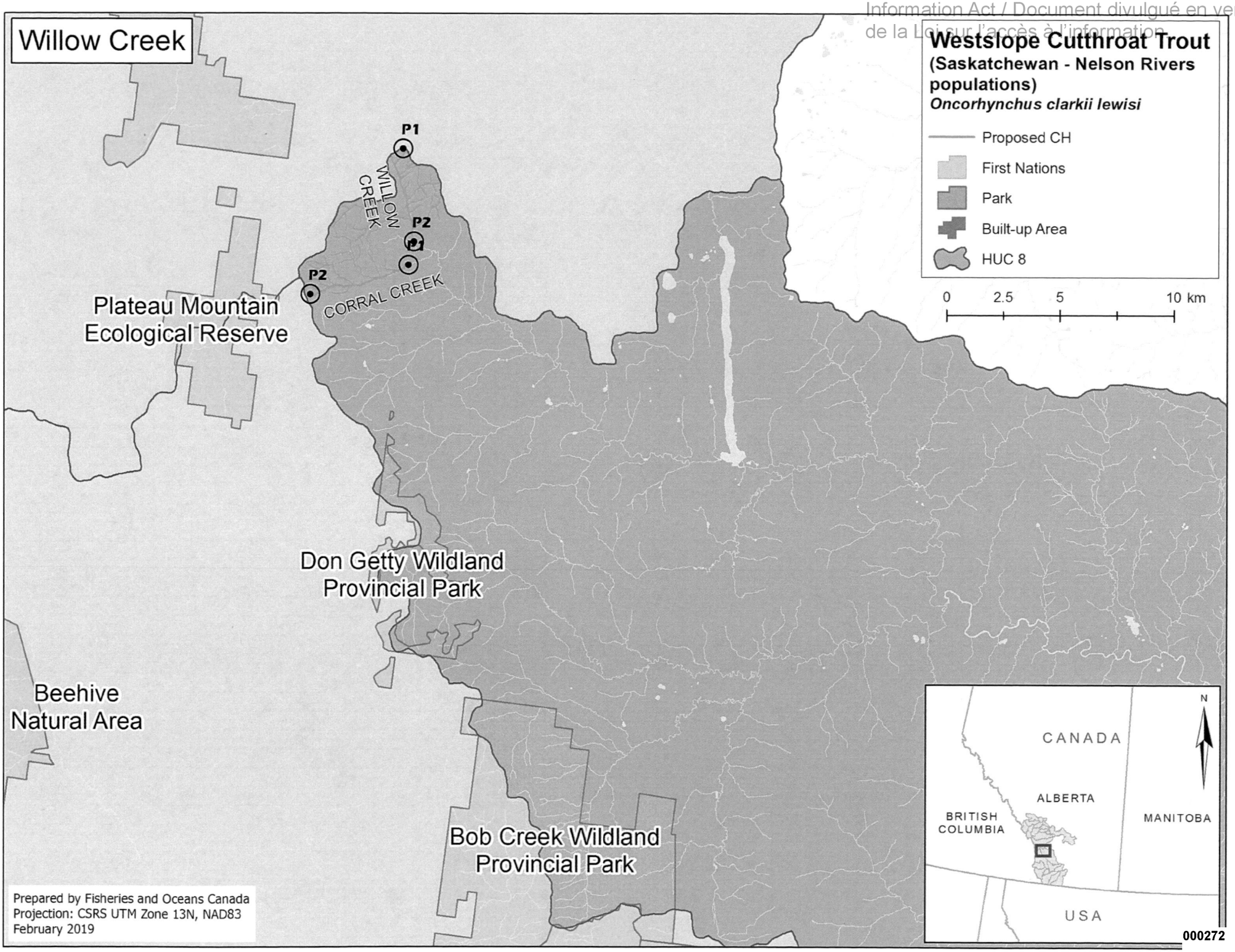


Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

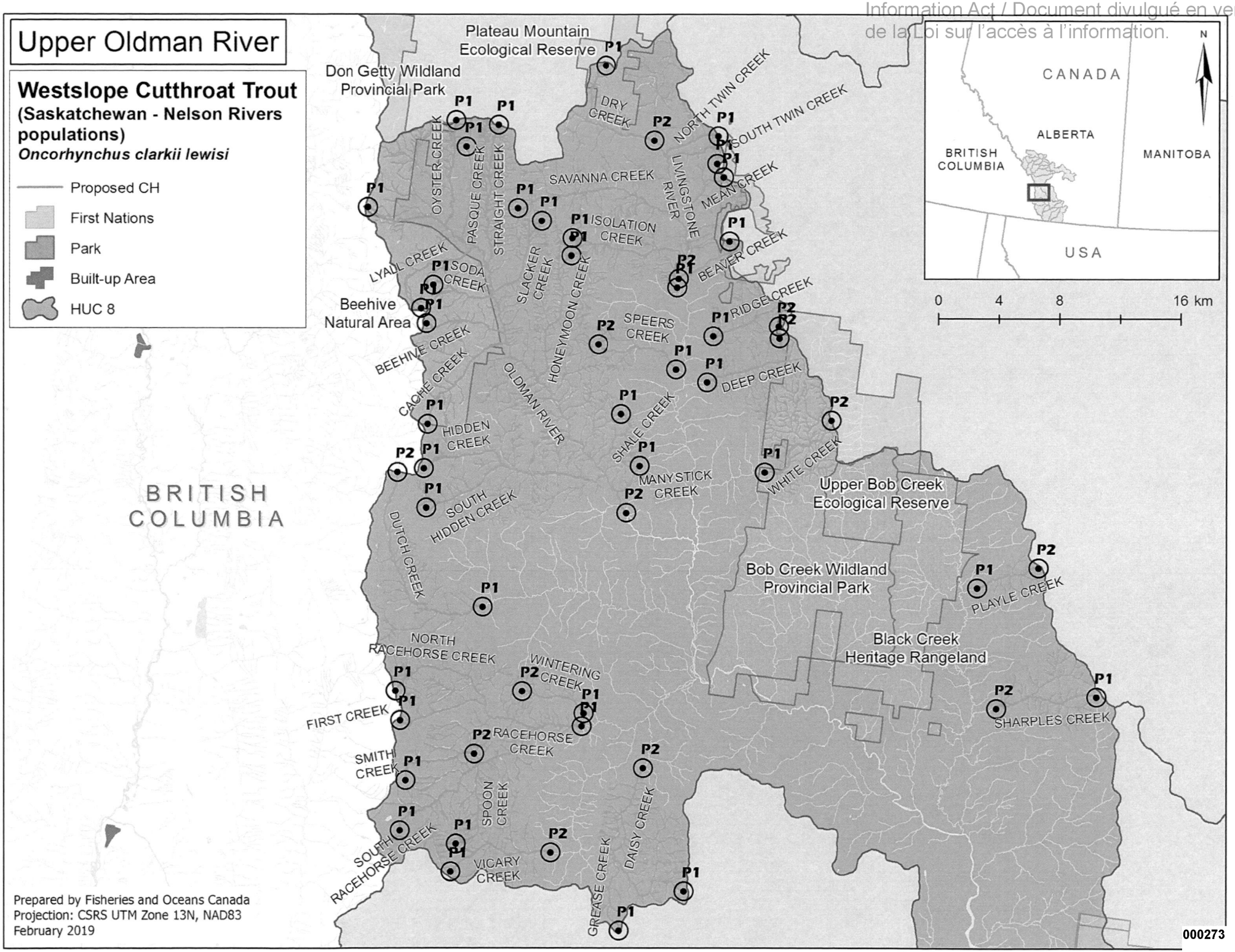
000270



000271



000272



Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
February 2019

000273

190 232 255

Coordinates that were switched P1 -> P2
Syncline Brook
Girardi Creek
Picklejar Creek
Odlum Creek
Etherington Creek
Zephyr Creek
Lusk Creek
Dutch Creek
Playle Creek
White Creek
Deep Creek
Ridge Creek
Speers Creek
Wintering Creek
Forty Mile Creek
Bryant Creek
Waiparous Creek added P2 renamed from Ghost R.

New coordinates
Unnamed Tributaries to Rock Creek
Picklejar Lakes 4 and 2
Unnamed Tributaries to Jumpingpound Creek

Watson, Ernest

From: Gillespie, Ashley
Sent: Friday, March 1, 2019 3:26 PM
To: Mitton-Wilkie, Cynthia J; Thomas, Jennifer; Ross, Bev; Postma, Lianne; Beirnes, Ron; Andres, Sheri; Hiltz, Beth; diane.casimir@pc.gc.ca; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' (Craig.Johnson@gov.ab.ca); Sue Cotterill; Paul Christensen; Rob Simieritsch; Valere, Brent; Shelley.Humphries@pc.gc.ca; Poliquin, André; Sawatzky, Chantelle
Cc: Curtis, Martyn; Cudmore, Becky; Watson, Ernest
Subject: RE: FOR ACTION: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited Jurisdictional / National review

Hi everyone,

I have placed the updated proposed maps at the site below. As Ernie mentioned, the maps have been updated to include the P1 and P2 points referenced in the document and have also been updated to include more detail. These maps, pending revisions after your comments, will be included in the proposed recovery strategy-action plan.

ftp://ftp.dfo-mpo.gc.ca/GillespieA

Have a great weekend,

Ashley

From: Watson, Ernest <Ernest.Watson@dfo-mpo.gc.ca>
Sent: Monday, February 25, 2019 6:52 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; diane.casimir@pc.gc.ca; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' (Craig.Johnson@gov.ab.ca) <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; Rob Simieritsch <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; Shelley.Humphries@pc.gc.ca; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>; Sawatzky, Chantelle <Chantelle.Sawatzky@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>; Cudmore, Becky <Becky.Cudmore@dfo-mpo.gc.ca>; Gillespie, Ashley <Ashley.Gillespie@dfo-mpo.gc.ca>
Subject: FOR ACTION: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited Jurisdictional / National review

Hello All:

Please find attached the draft Westslope Cutthroat Trout Recovery Strategy- Action (RS-AP), which includes the draft Federal RS-AP (Part 1) and the Alberta Recovery Plan (Part 2).

PLEASE NOTE, you are being asked to only review the RS-AP (Part 1), the federal portion: we are proposing to adopt the 2012-2017 AB recovery plan as-is. Since Part 1 references Part 2 for many sections, it has been included in the document. For your convenience, part 1 has also been provided as separate document.

Please provide comments by **MARCH 13** form using the attached comment form, referencing the line number and specific comment. If more than one reviewer is using the same form, each individual is asked to add separate columns for person providing the comment.

Please note that the section on critical habitat for lakes will soon be updated to include updated specific coordinates. Each Critical Habitat map will also be updated to depict the end points that are referenced in the tables (each waterbody have a P1 and P2 point: these points will be included in updated maps).

Thanks for your understanding of the tight timelines involved in this expedited review. Please let me know if you have any questions.

Ernie.

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

From: Watson, Ernest
Sent: Thursday, February 14, 2019 5:08 PM
To: Mitton-Wilkie, Cynthia J <Cynthia.Mitton-Wilkie@DFO-MPO.GC.CA>; Thomas, Jennifer <Jennifer.Thomas@dfo-mpo.gc.ca>; Ross, Bev <Bev.Ross@dfo-mpo.gc.ca>; Postma, Lianne <Lianne.Postma@dfo-mpo.gc.ca>; Beirnes, Ron <Ron.Beirnes@dfo-mpo.gc.ca>; Andres, Sheri <Sheri.Andres@DFO-MPO.GC.CA>; Hiltz, Beth <Beth.Hiltz@dfo-mpo.gc.ca>; 'diane.casimir@pc.gc.ca' <diane.casimir@pc.gc.ca>; 'Craig Johnson (Craig.Johnson@gov.ab.ca)' <Craig.Johnson@gov.ab.ca>; Sue Cotterill <Sue.Cotterill@gov.ab.ca>; Paul Christensen <Paul.Christensen@gov.ab.ca>; 'Rob Simieritsch' <Rob.Simieritsch@gov.ab.ca>; Valere, Brent <Brent.Valere@dfo-mpo.gc.ca>; 'Shelley.Humphries@pc.gc.ca' <Shelley.Humphries@pc.gc.ca>; Poliquin, André <Andre.Poliquin@dfo-mpo.gc.ca>
Cc: Curtis, Martyn <Martyn.Curtis@dfo-mpo.gc.ca>
Subject: HEADS UP: Westslope Cutthroat Trout Recovery Strategy – Action Plan expedited review
Importance: High

Hello All:

As you probably know, DFO had been required to develop a Westslope Cutthroat Trout action plan by March 31, 2015. In October of 2017, DFO published a summary of the Recovery Strategy-Action Plan explaining the decision to develop a document which combines an amended Recovery Strategy–Action Plan, rather than a stand-alone action plan, that would meet the requirements of both a recovery strategy and an action plan under the Species at Risk Act. The summary also explained that DFO delayed the completion of the Recovery Strategy–Action Plan so as to include the most thorough and up-to-date genetic information for the species, allowing the identification of additional critical habitat and development of appropriate recovery actions (strategic direction for recovery) based on the genetic status' of populations.

The Species at Risk Program received the up-to-date genetic information on February 4th, and we intend to intend to quickly identify the additional critical habitat and complete the draft Recovery Strategy–Action Plan.

We are now planning to expedite the development of the Recovery Strategy – Action Plan that would:

- adopt the Alberta Westslope Cutthroat Trout Recovery Plan 2012-2017;
- include additional the critical habitat, based on the most up-to-date genetic information;
- include a description of riparian critical habitat; and
- include the strategic direction for recovery and implementation schedule (recovery actions).
-

As a heads up, we are following an expedited timeframe for document review and approval, from draft to proposed stage: we have a proposed 2.5 week turn-around for Regional, Sectoral, Jurisdictional and National review starting on February 25th.

The proposed critical path is as follows:

Weeks required	Start Date	Step
1	14 February 2019	Prepare draft RS-AP
2.5	25 February 2019	Send draft document for Regional, Sectoral, Jurisdictional and National review
2	13 March 2019	SARP to revise document based on comments
2	27 March 2019	Send proposed document to NHQ for Ministerial approval and posting

Please let me know if you have any questions regarding the above,

Thanks! Ernie.

Ernest Watson

Team Leader, Species At Risk Program
Fisheries and Oceans Canada / Government of Canada
ernest.watson@dfo-mpo.gc.ca / Tel: 204-983-0611

Biologiste principal des espèces en péril, Programme des espèces en péril
Pêches et Océans Canada / Gouvernement du Canada
ernest.watson@dfo-mpo.gc.ca / Tél. : 204-983-0611

Pages 278 to / à 287

are duplicates of

sont des duplicatas des

pages 302 to / à 311

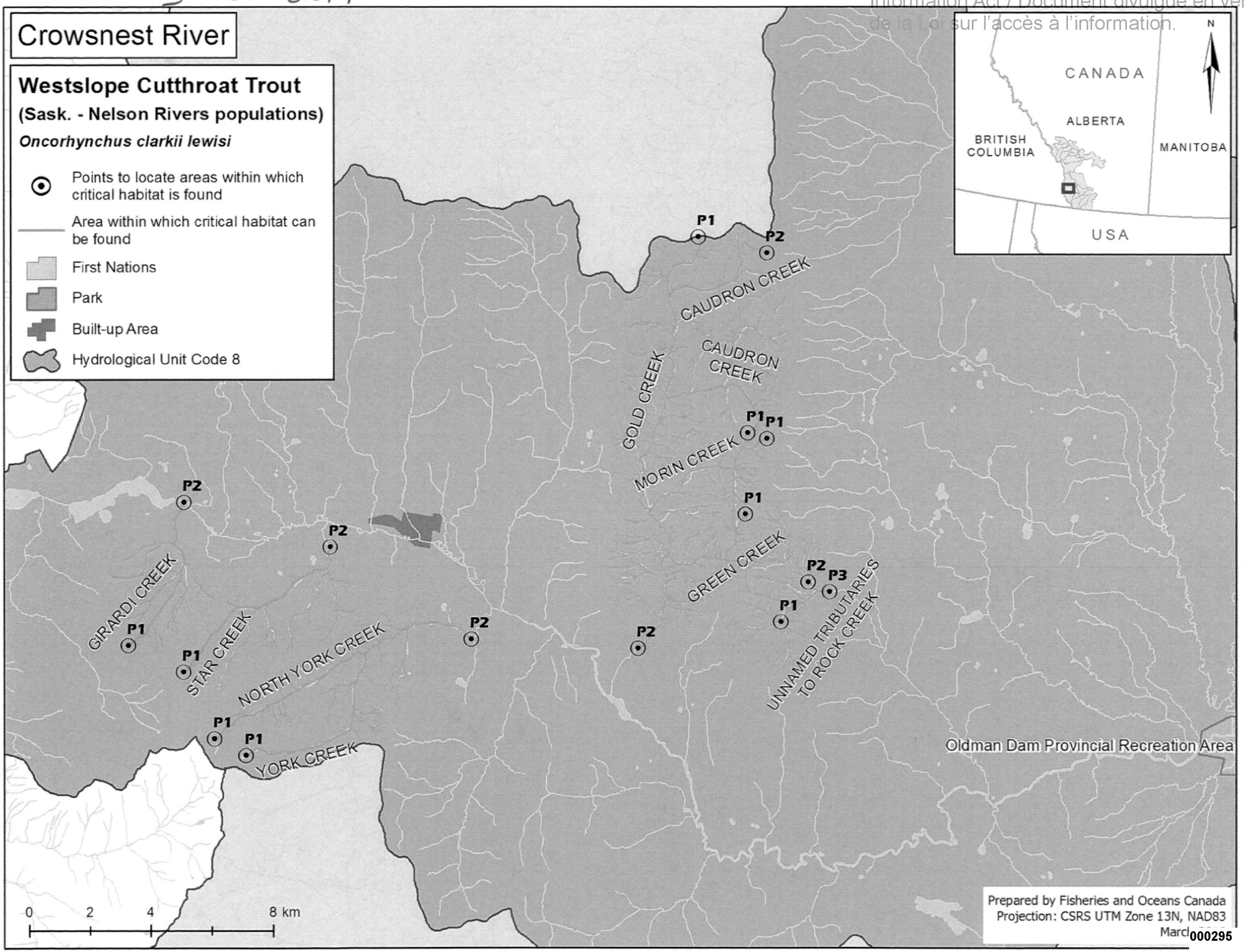
Pages 288 to / à 294

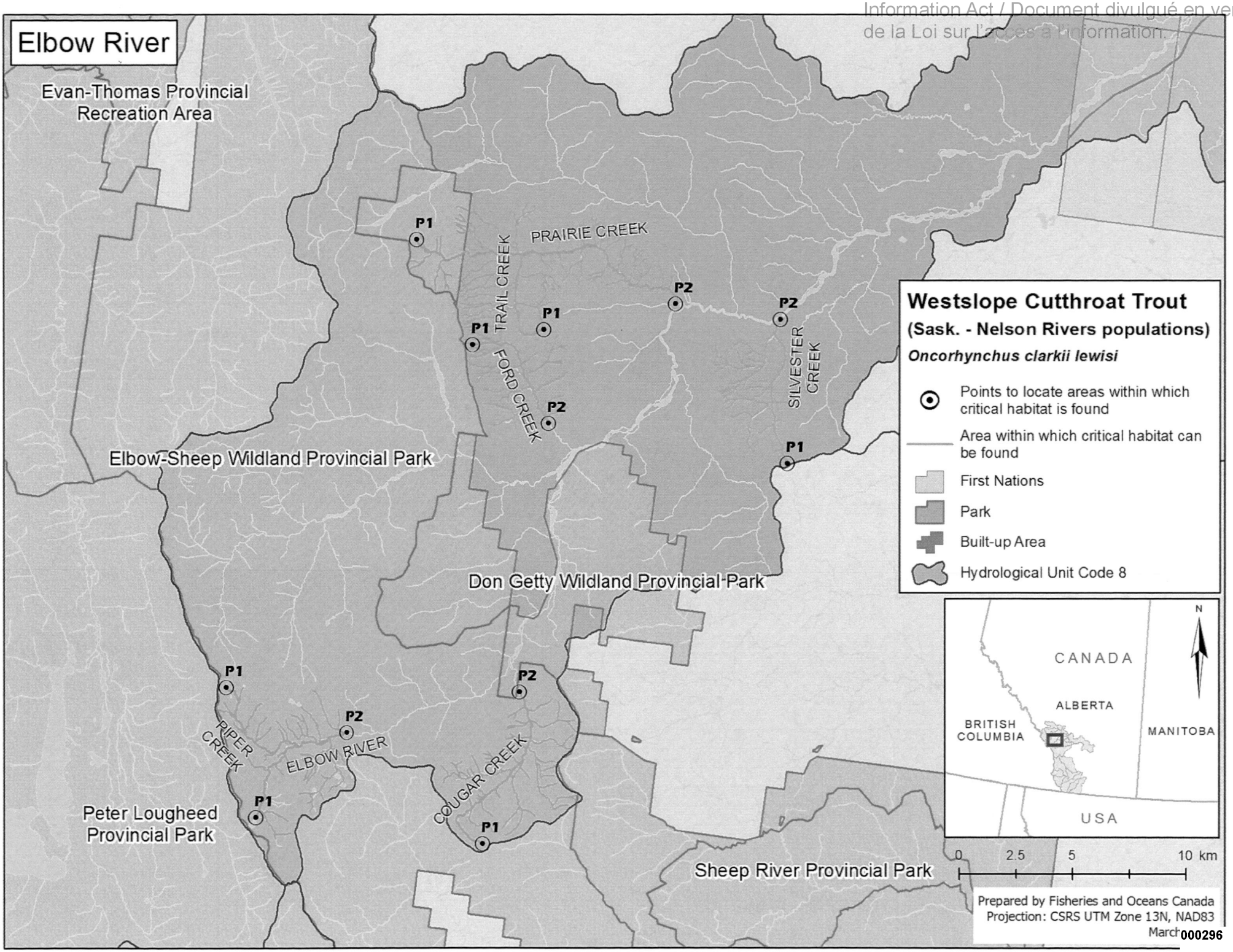
are duplicates of

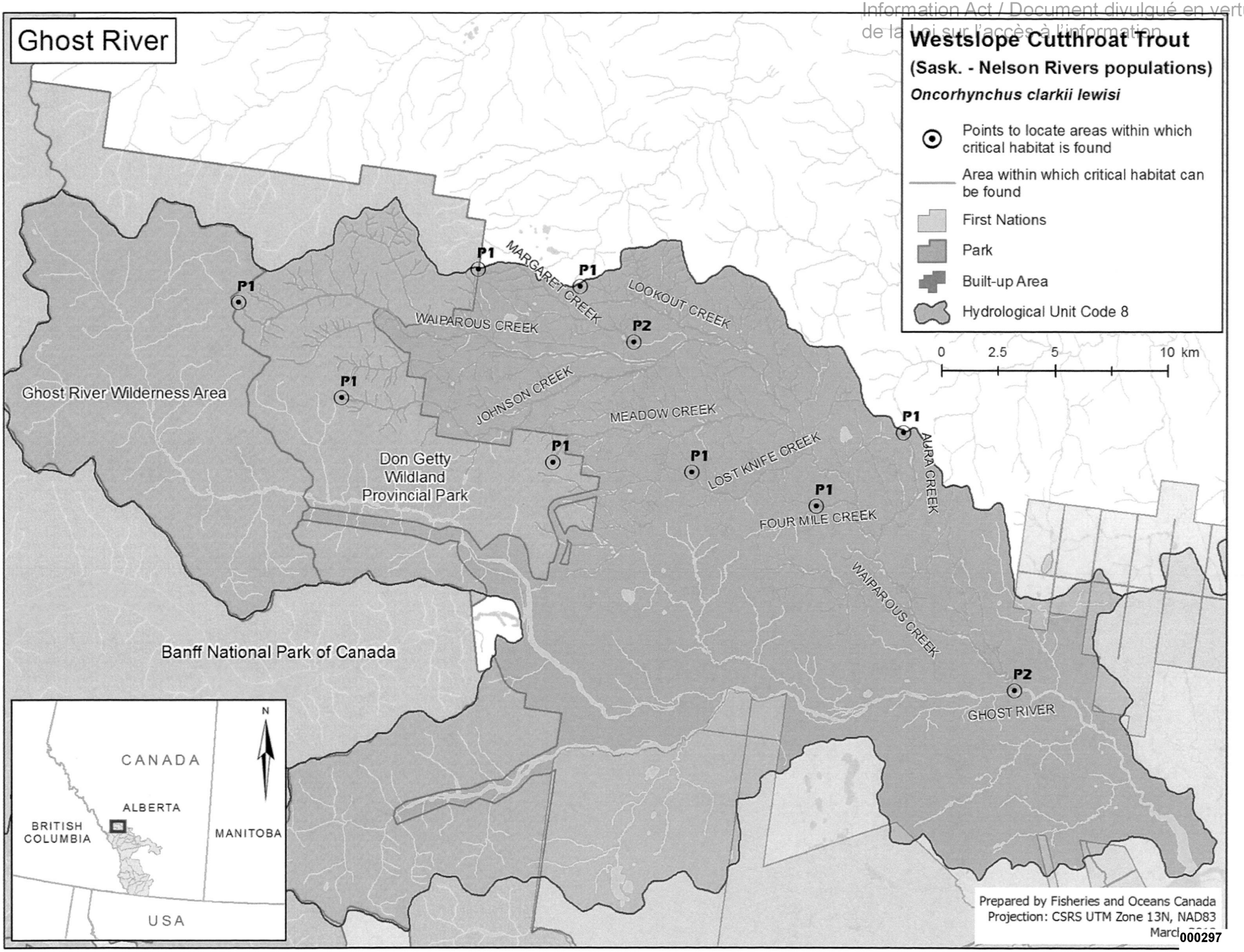
sont des duplicatas des

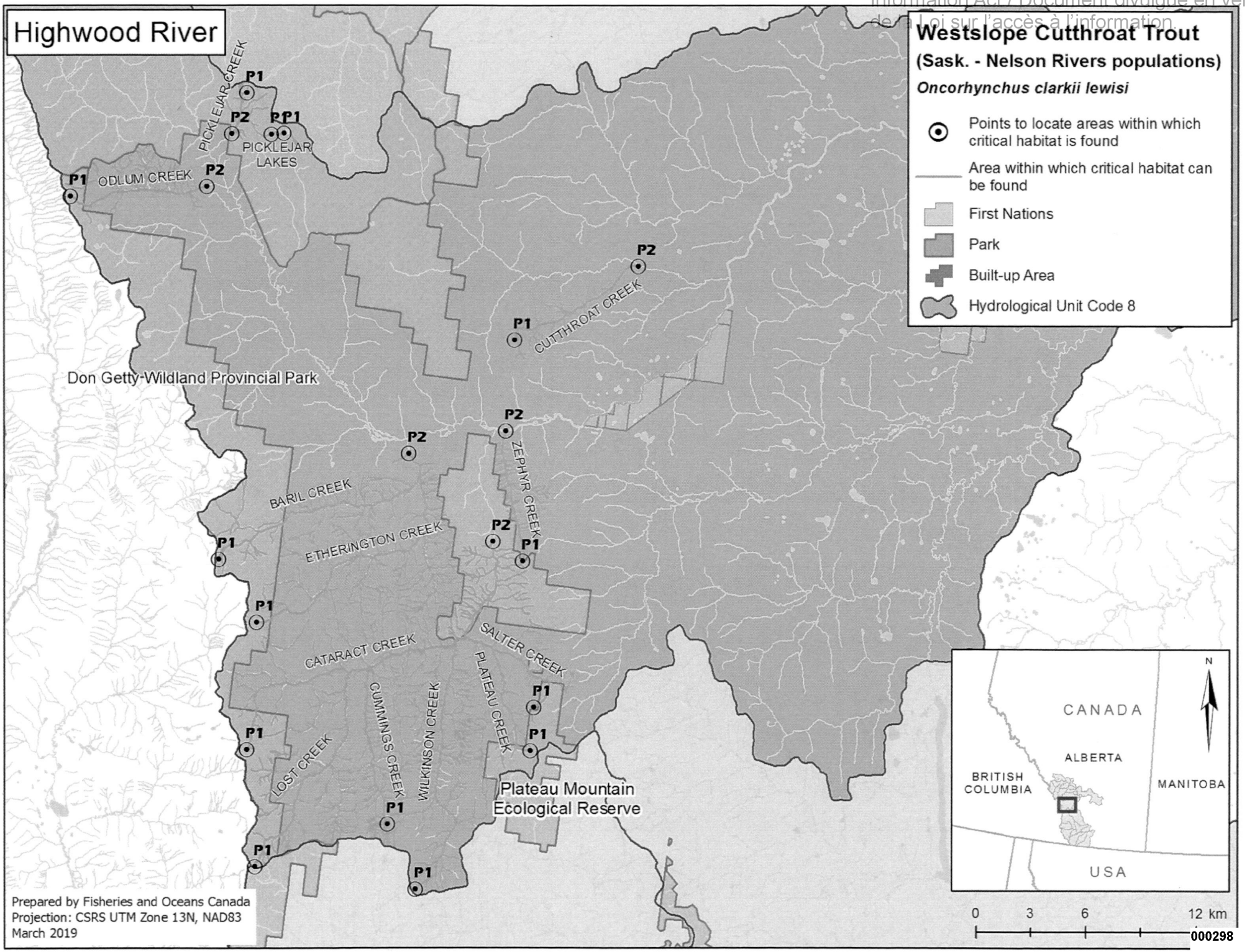
pages 295 to / à 301

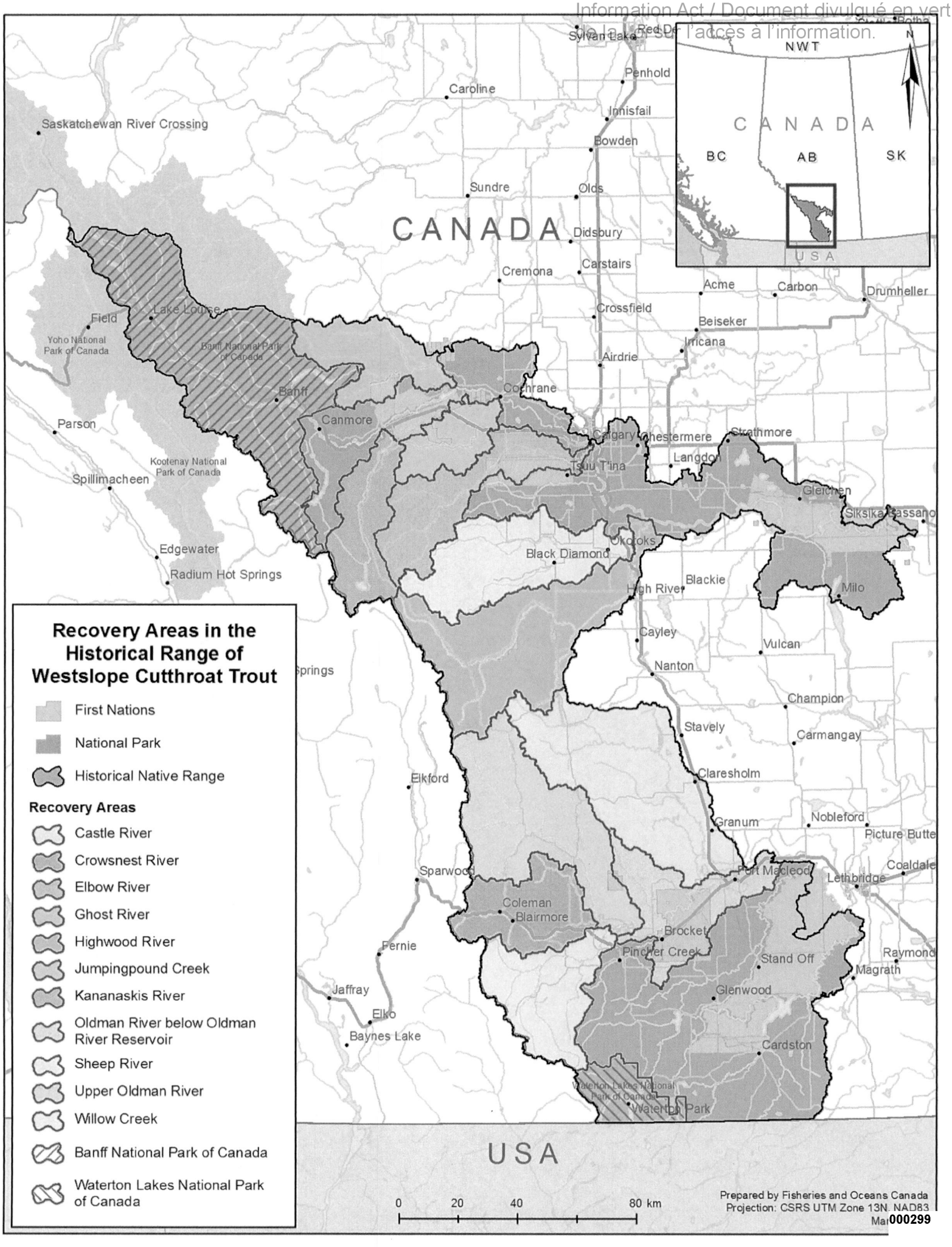
3-21-2019

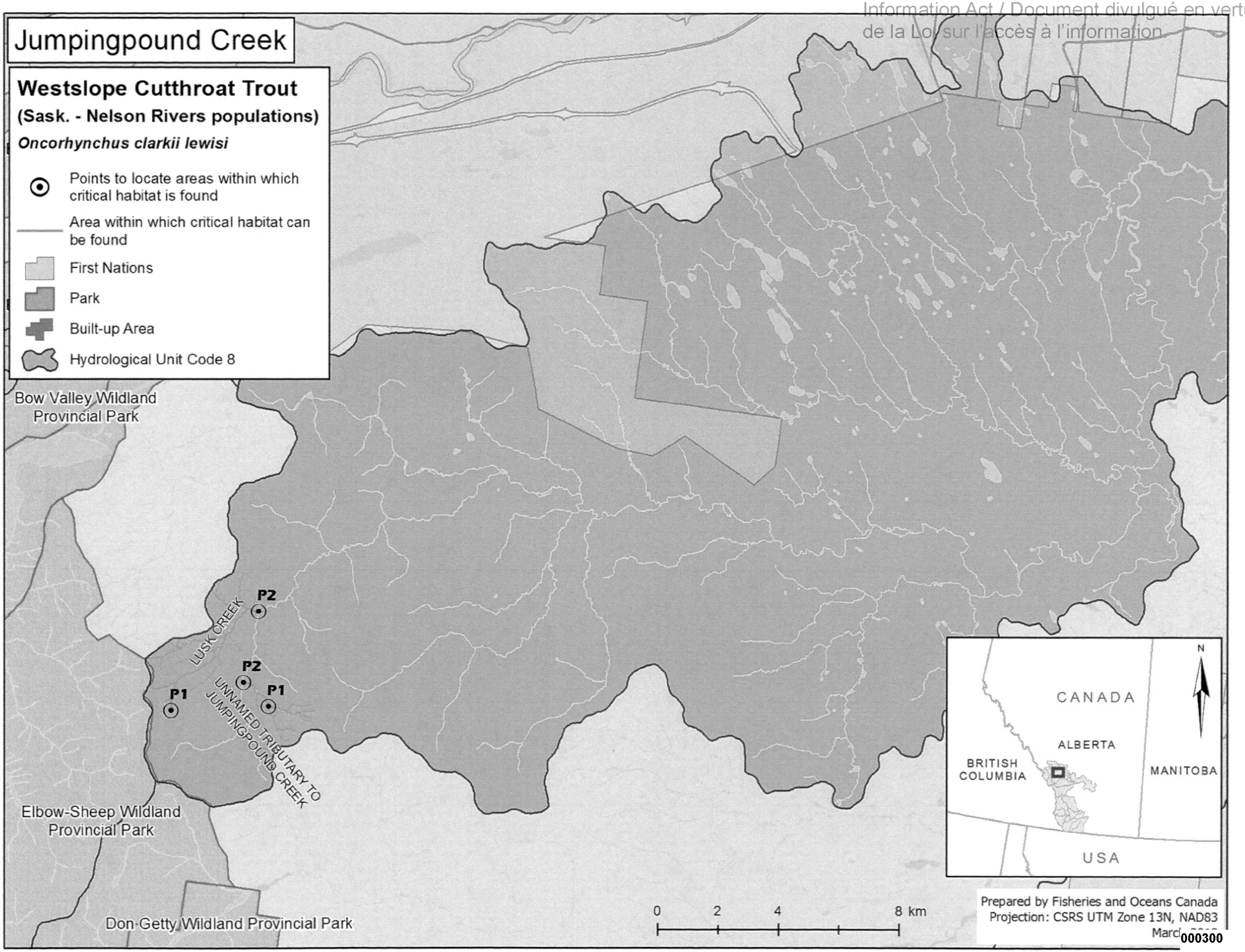


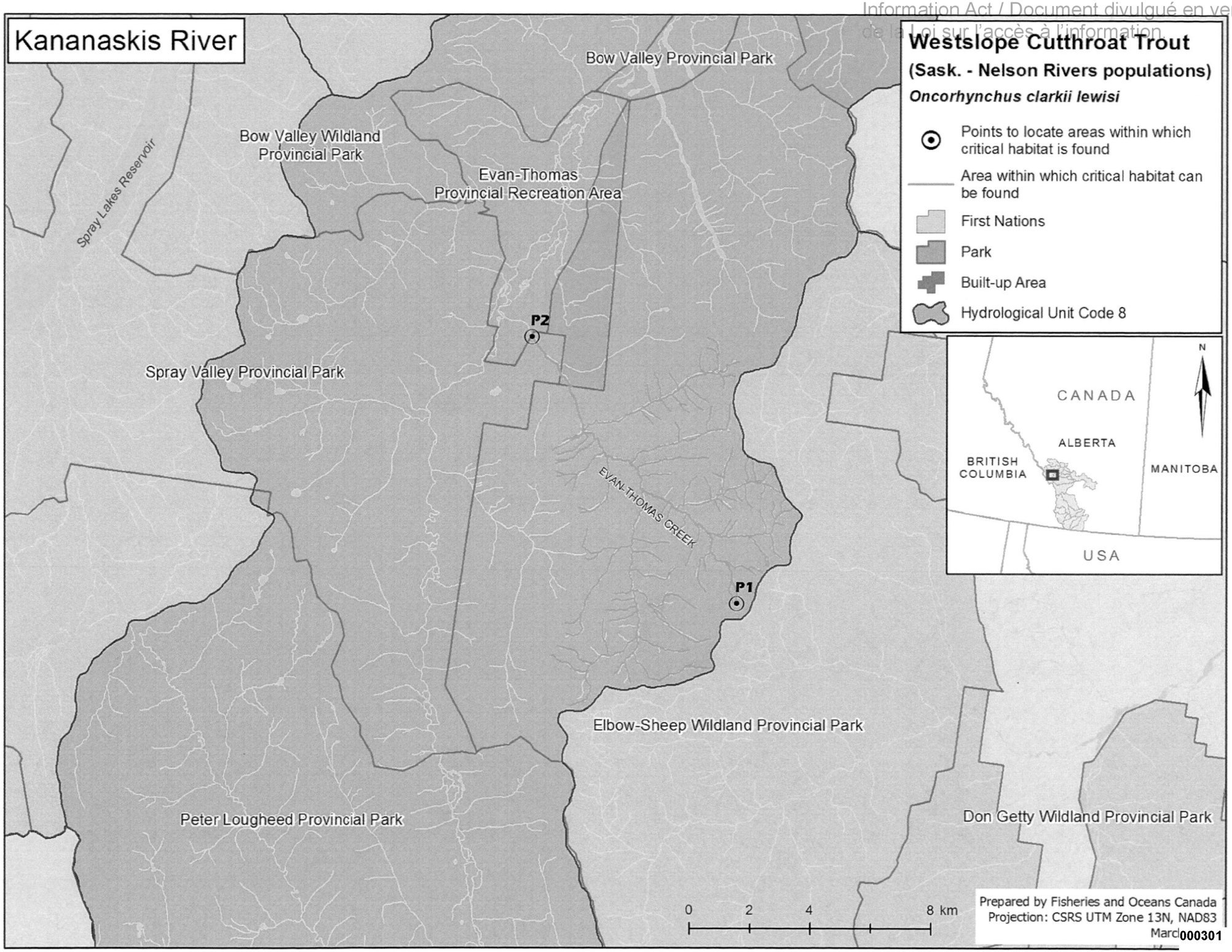


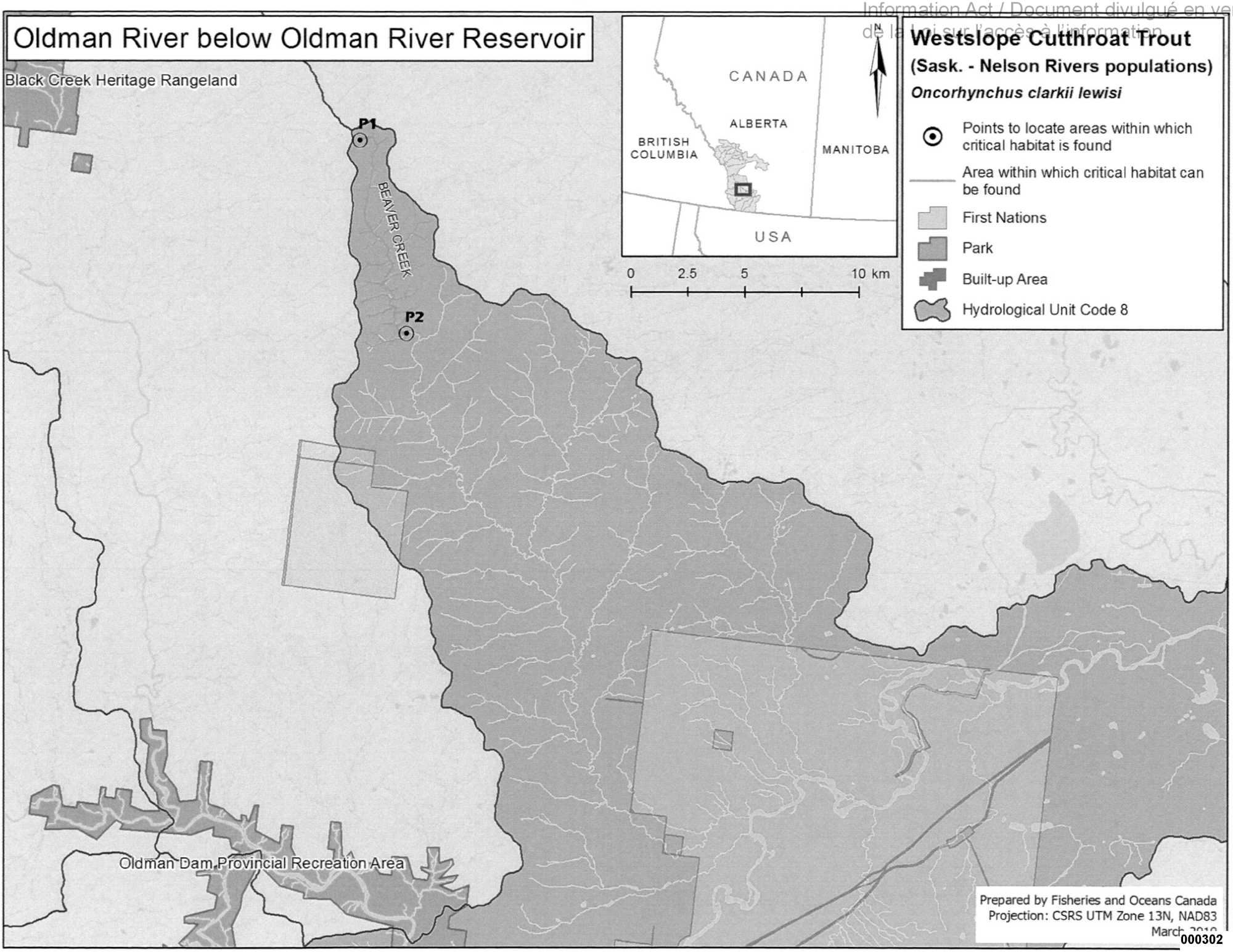


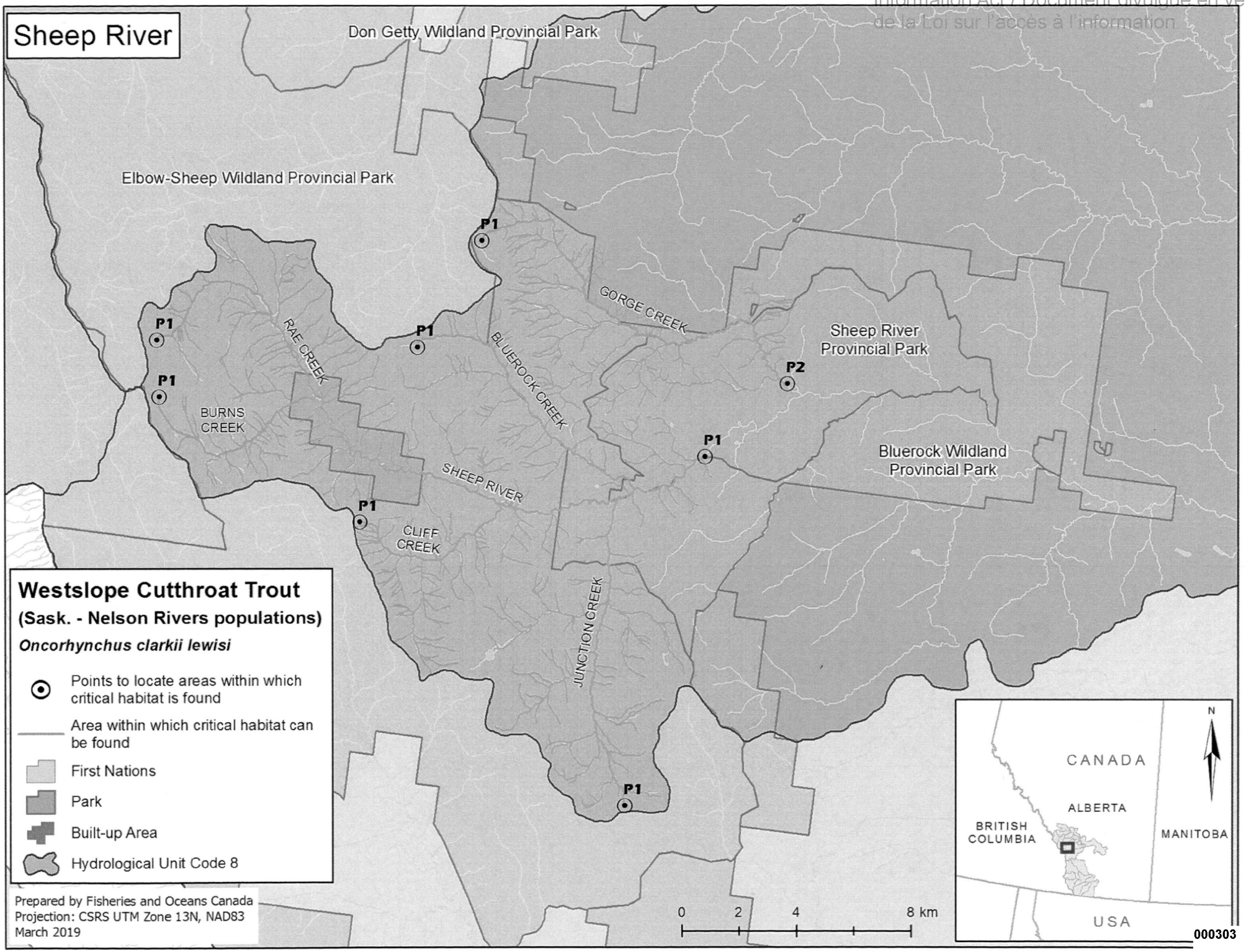












Upper Oldman River

Westslope Cutthroat Trout

(Sask. - Nelson Rivers populations)

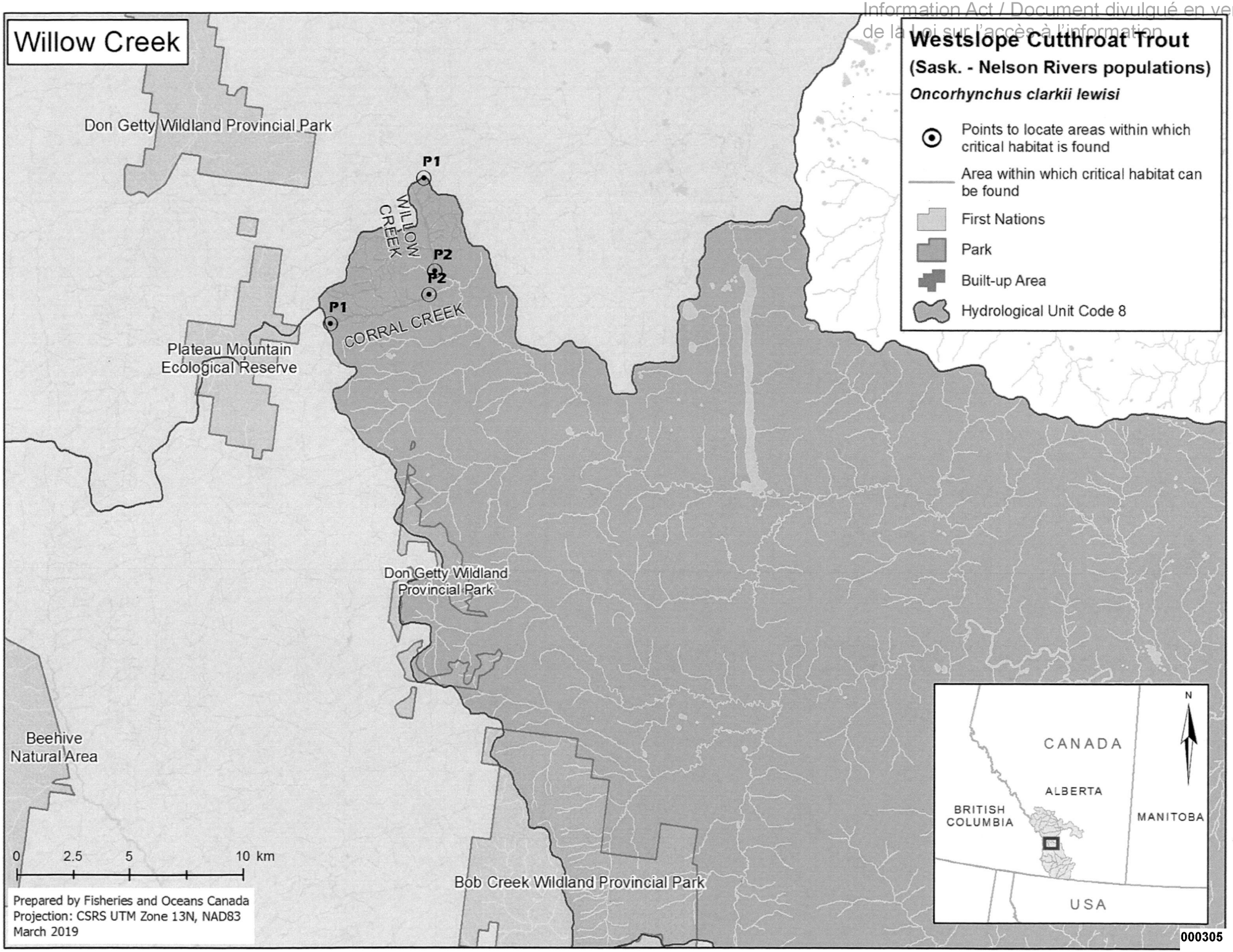
Oncorhynchus clarkii lewisi

- Points to locate areas within which critical habitat is found
- Area within which critical habitat can be found
- First Nations
- Park
- Built-up Area
- Hydrological Unit Code 8

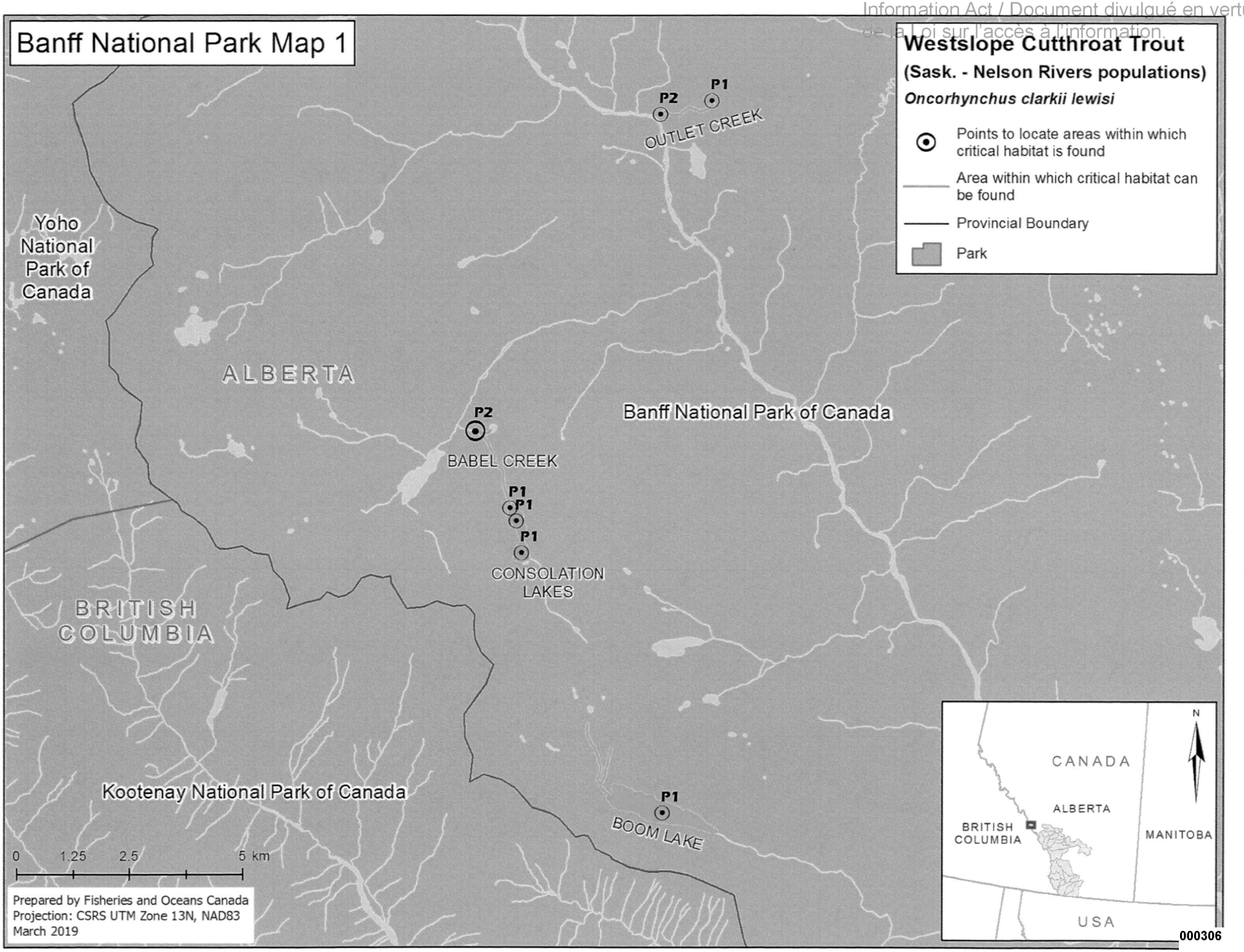
Plateau Mountain Ecological Reserve
DRY CREEK
NORTH TWIN CREEK
SOUTH TWIN CREEK
LIVINGSTONE RIVER
MEAN CREEK
Don Getty Wildland Provincial Park
OYSTER CREEK
PASQUE CREEK
STRAIGHT CREEK
SAVANNA CREEK
ISOLATION CREEK
SLACKER CREEK
HONEYMOON CREEK
BEAVER CREEK
RIDGE CREEK
LYALL CREEK
SODA CREEK
Beehive Natural Area
BEEHIVE CREEK
SPEERS CREEK
DEEP CREEK
CACHE CREEK
OLDMAN RIVER
HIDDEN CREEK
SHALE CREEK
MANYSTICK CREEK
WHITE CREEK
BRITISH COLUMBIA
SOUTH HIDDEN CREEK
DUTCH CREEK
Upper Bob Creek Ecological Reserve
Bob Creek Wildland Provincial Park
PLAYLE CREEK
NORTH RACEHORSE CREEK
WINTERING CREEK
Black Creek Heritage Rangeland
FIRST CREEK
SHARPLES CREEK
SMITH CREEK
RACEHORSE CREEK
SPOON CREEK
DAISY CREEK
SOUTH RACEHORSE CREEK
VICARY CREEK
GREASE CREEK

Prepared by Fisheries and Oceans Canada
Projection: CSRS UTM Zone 13N, NAD83
March 2019

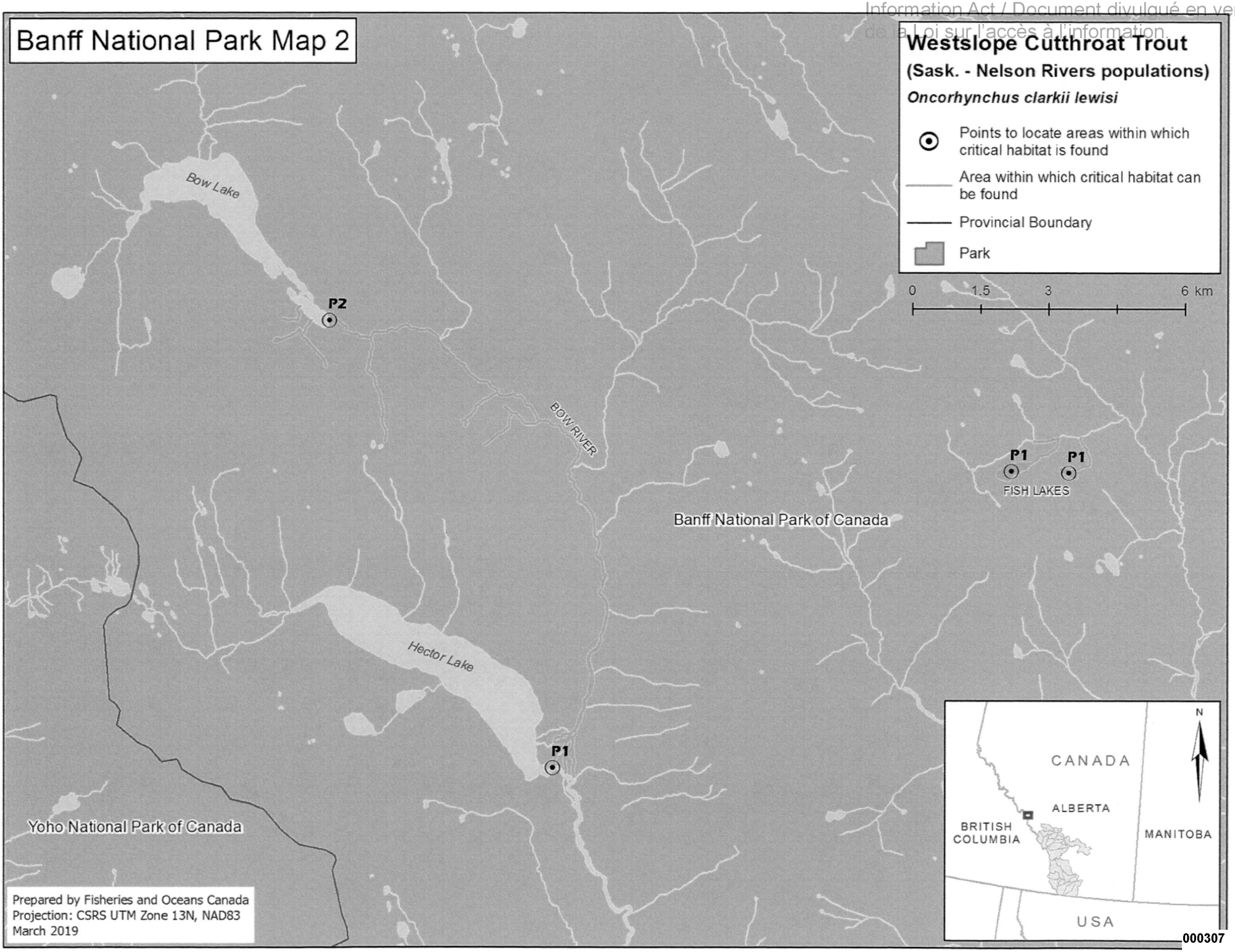
000304

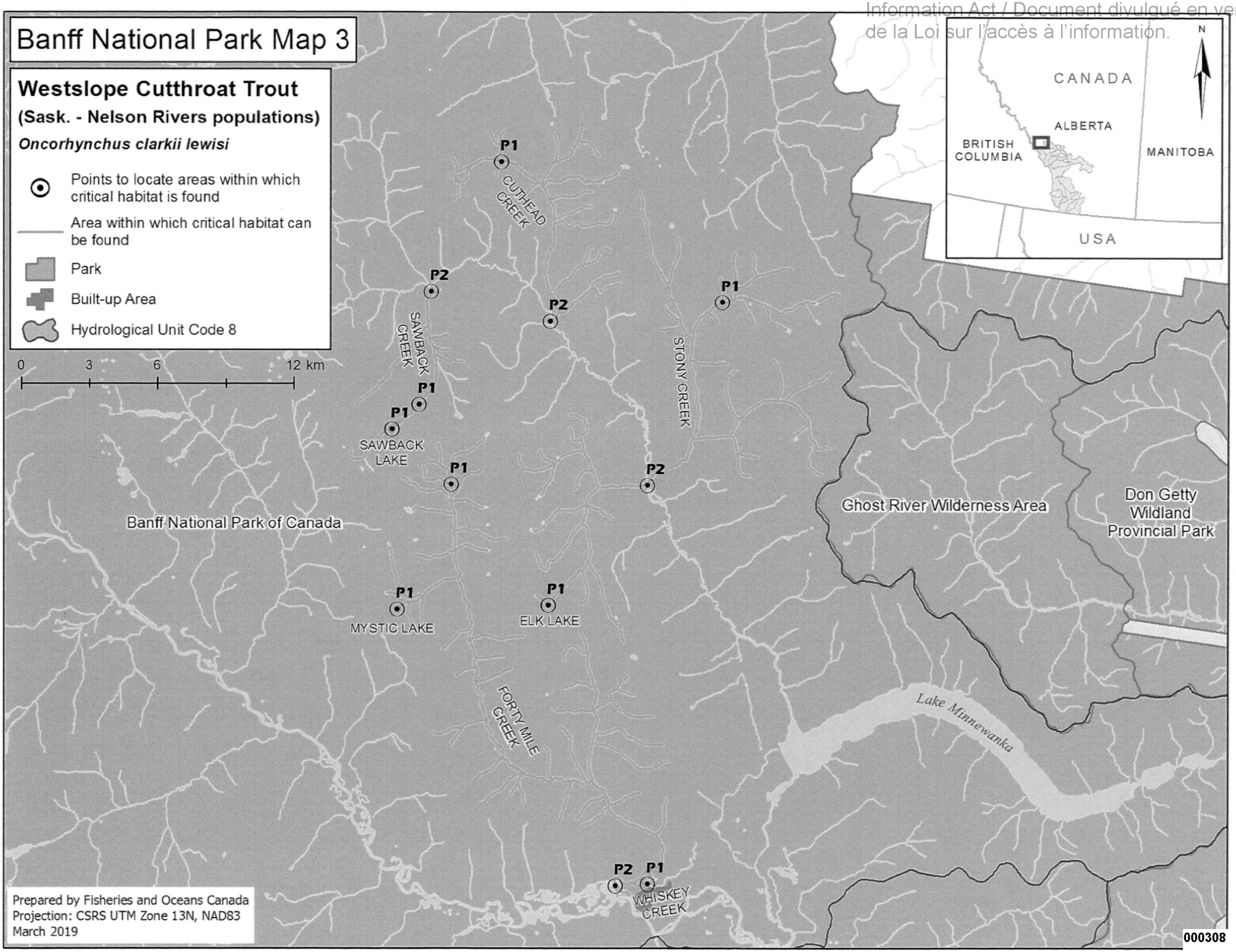


000305

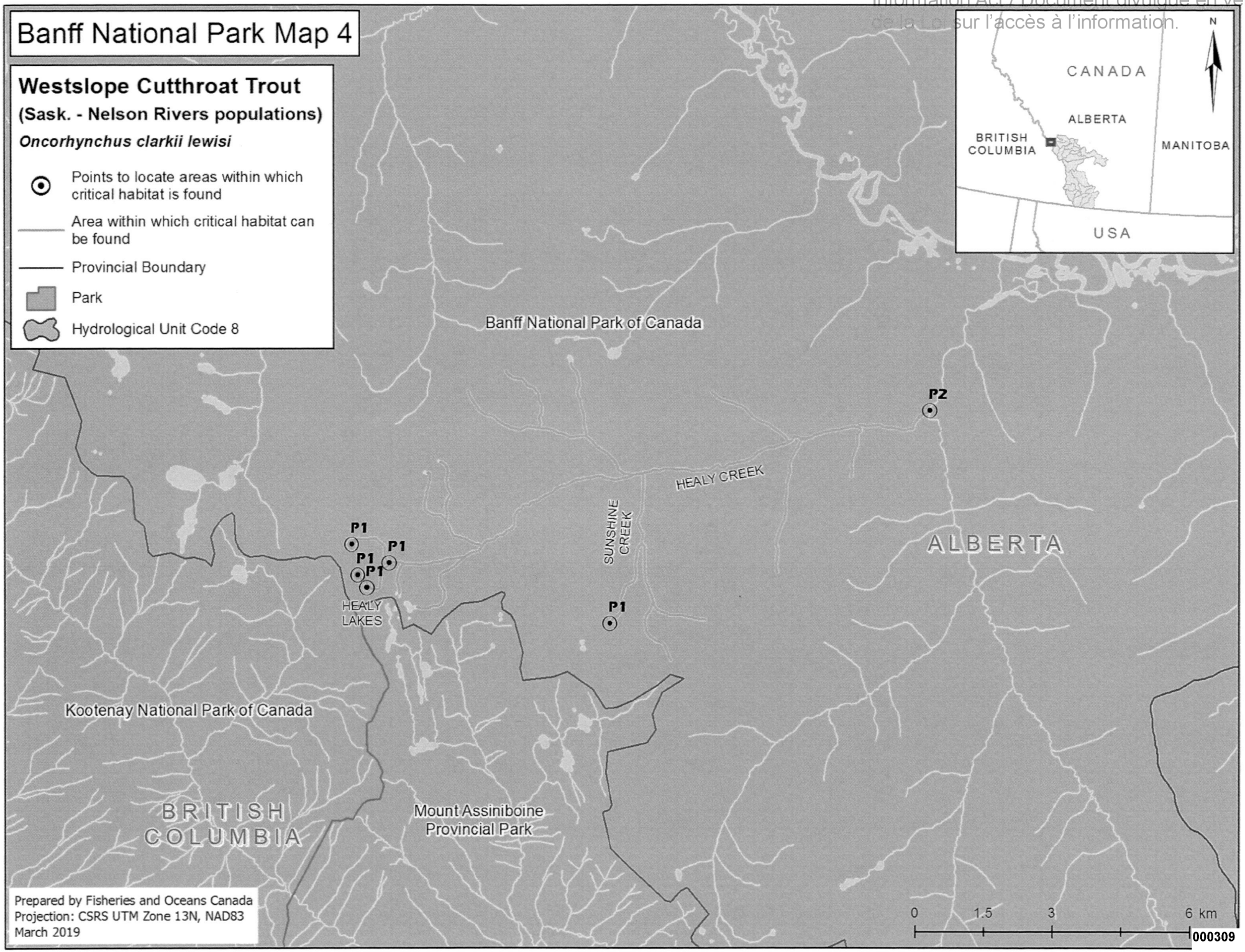


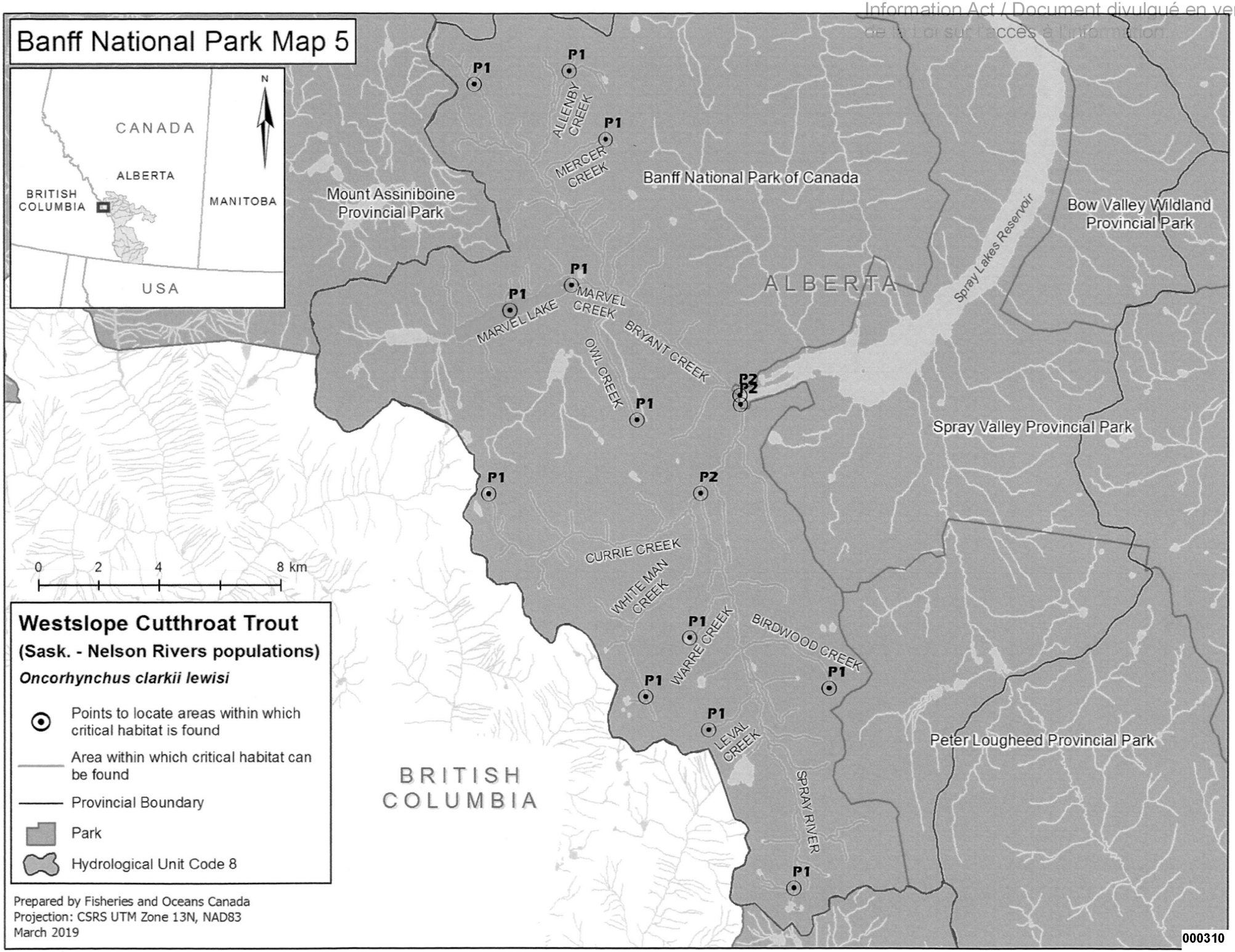
000306

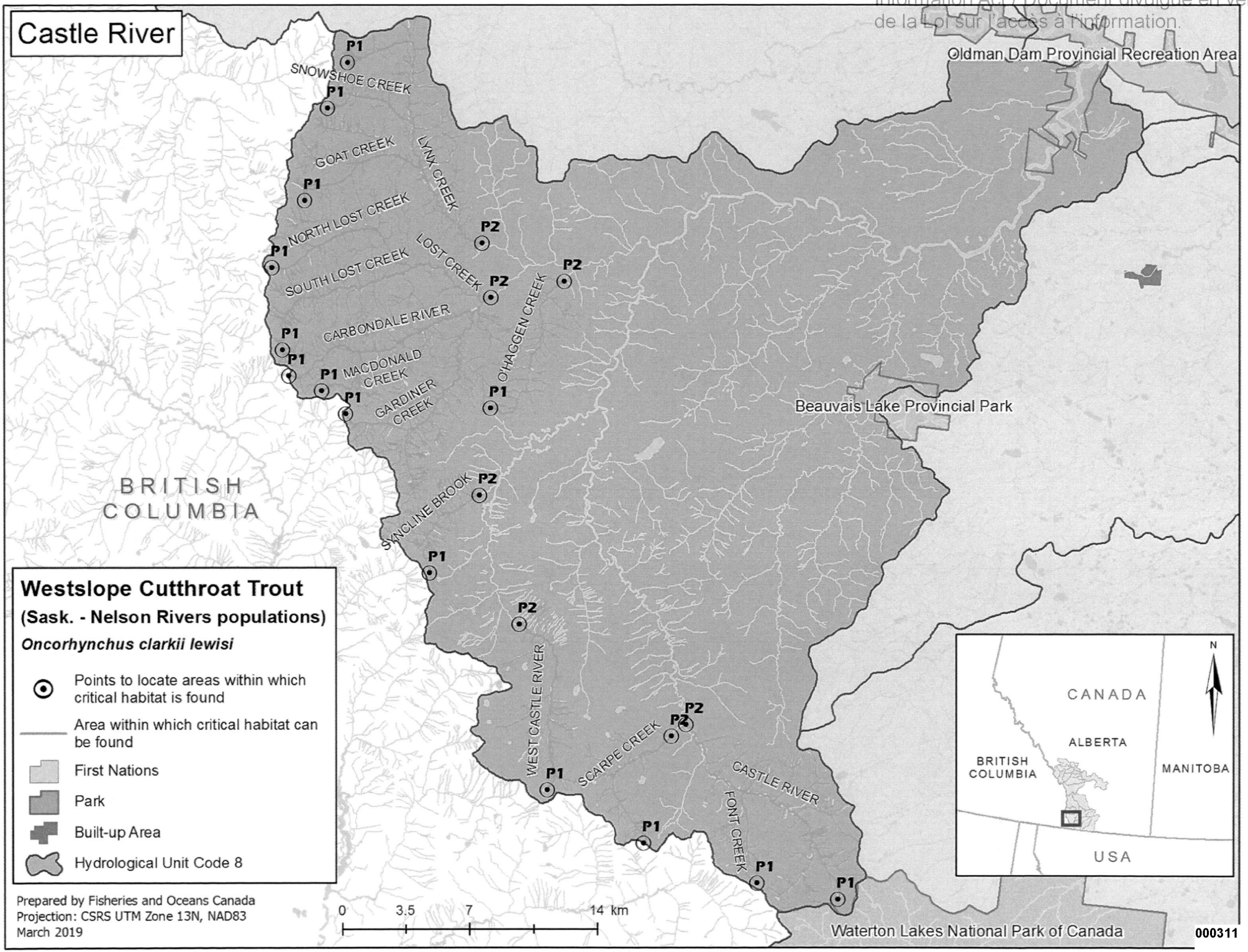


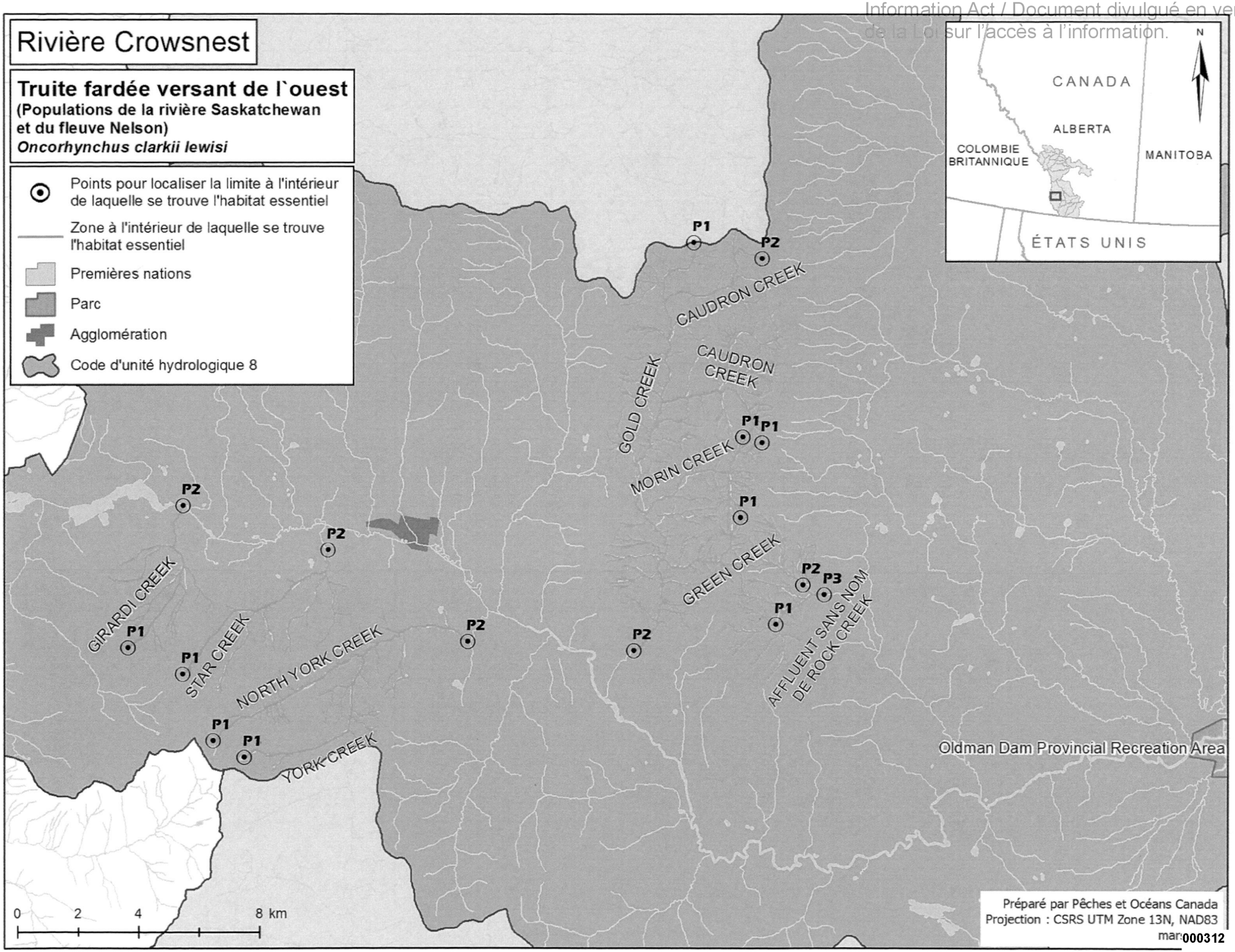


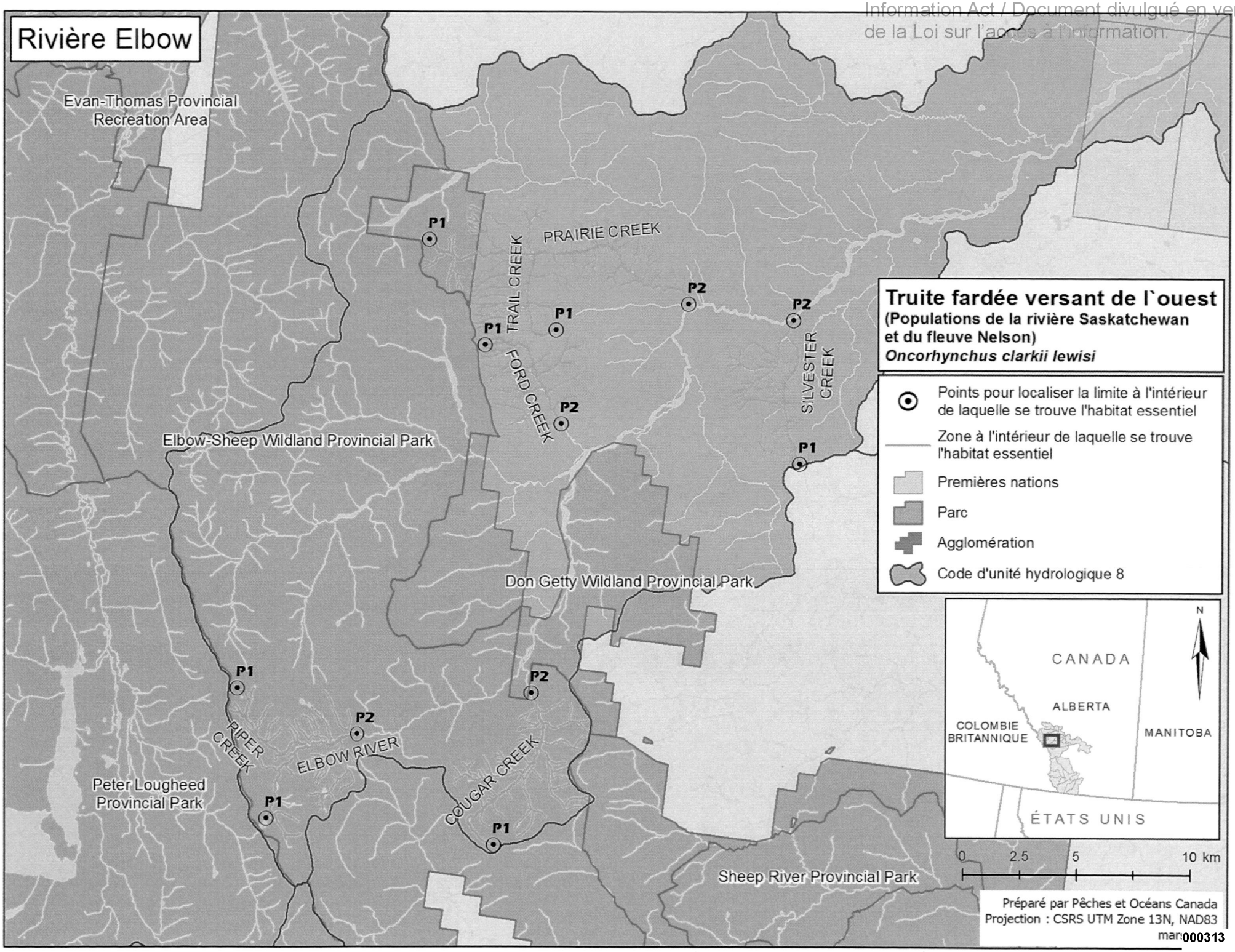
000308

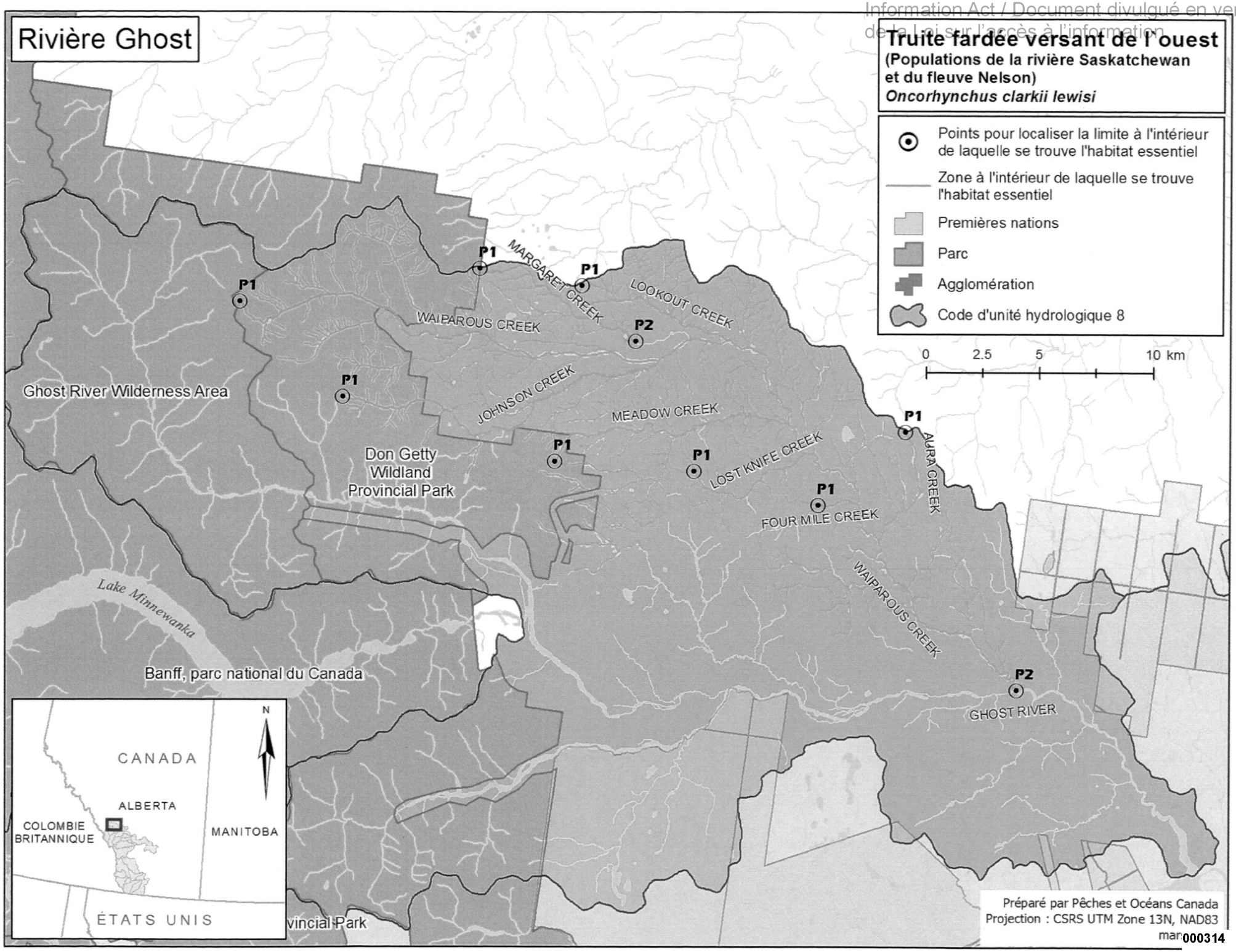


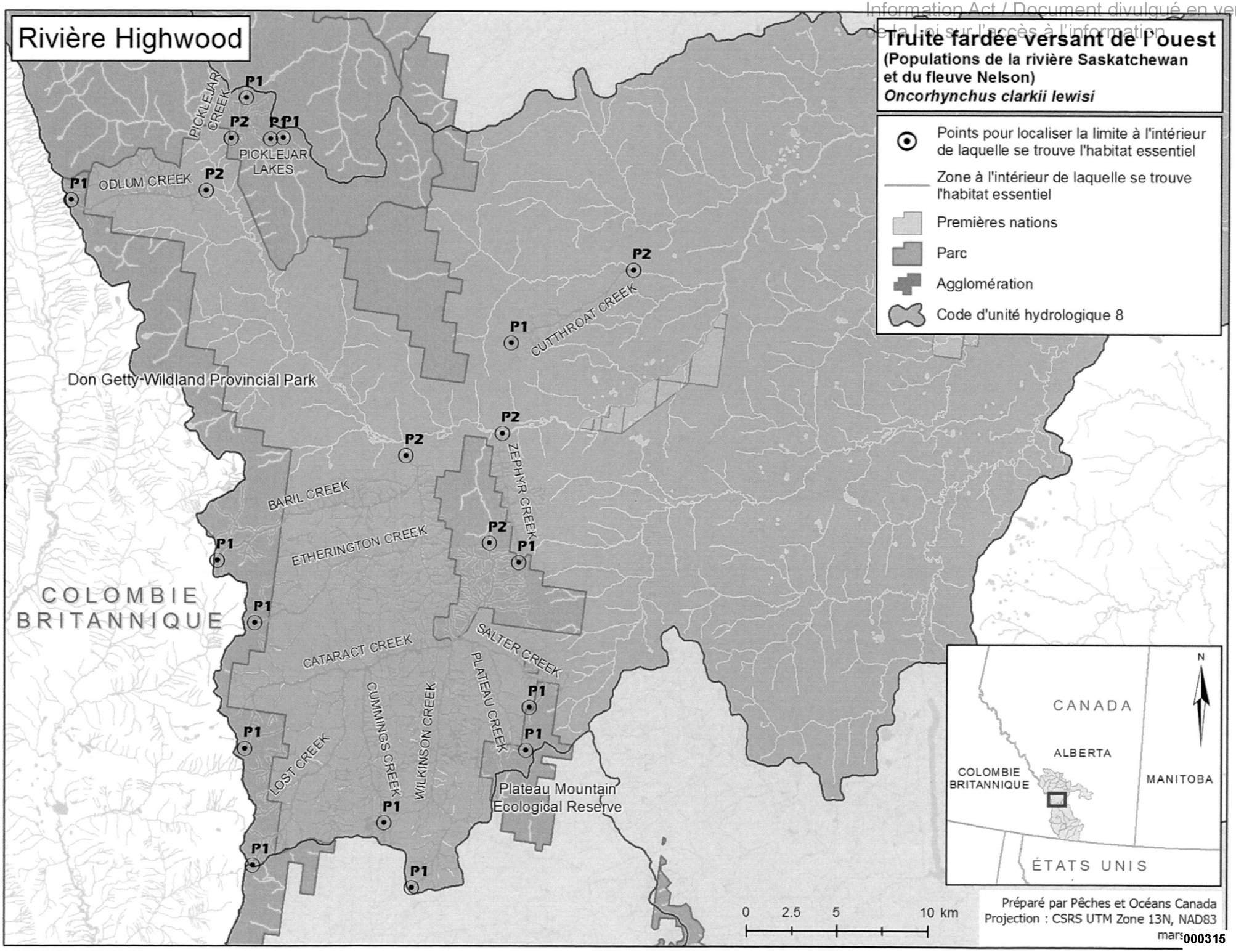


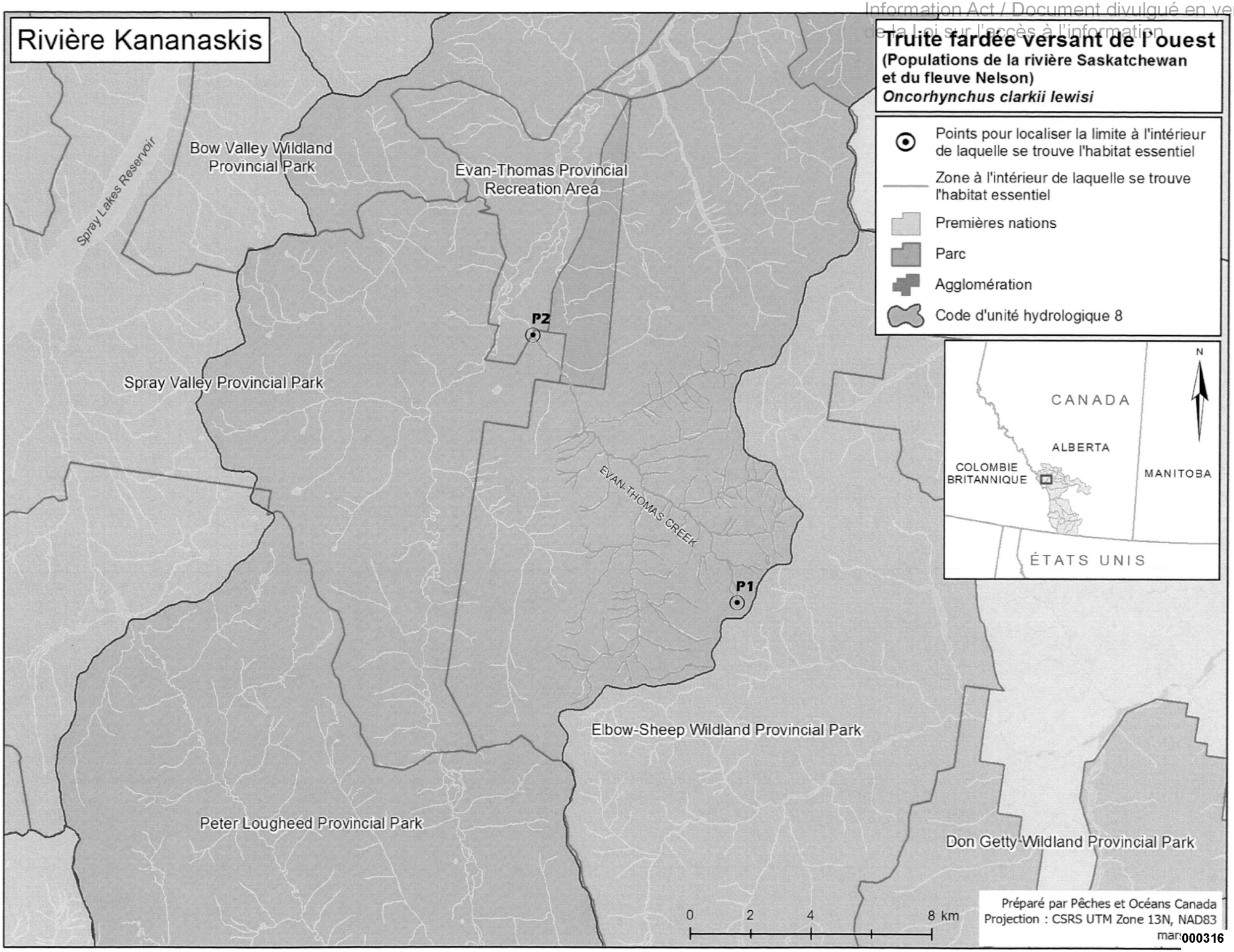


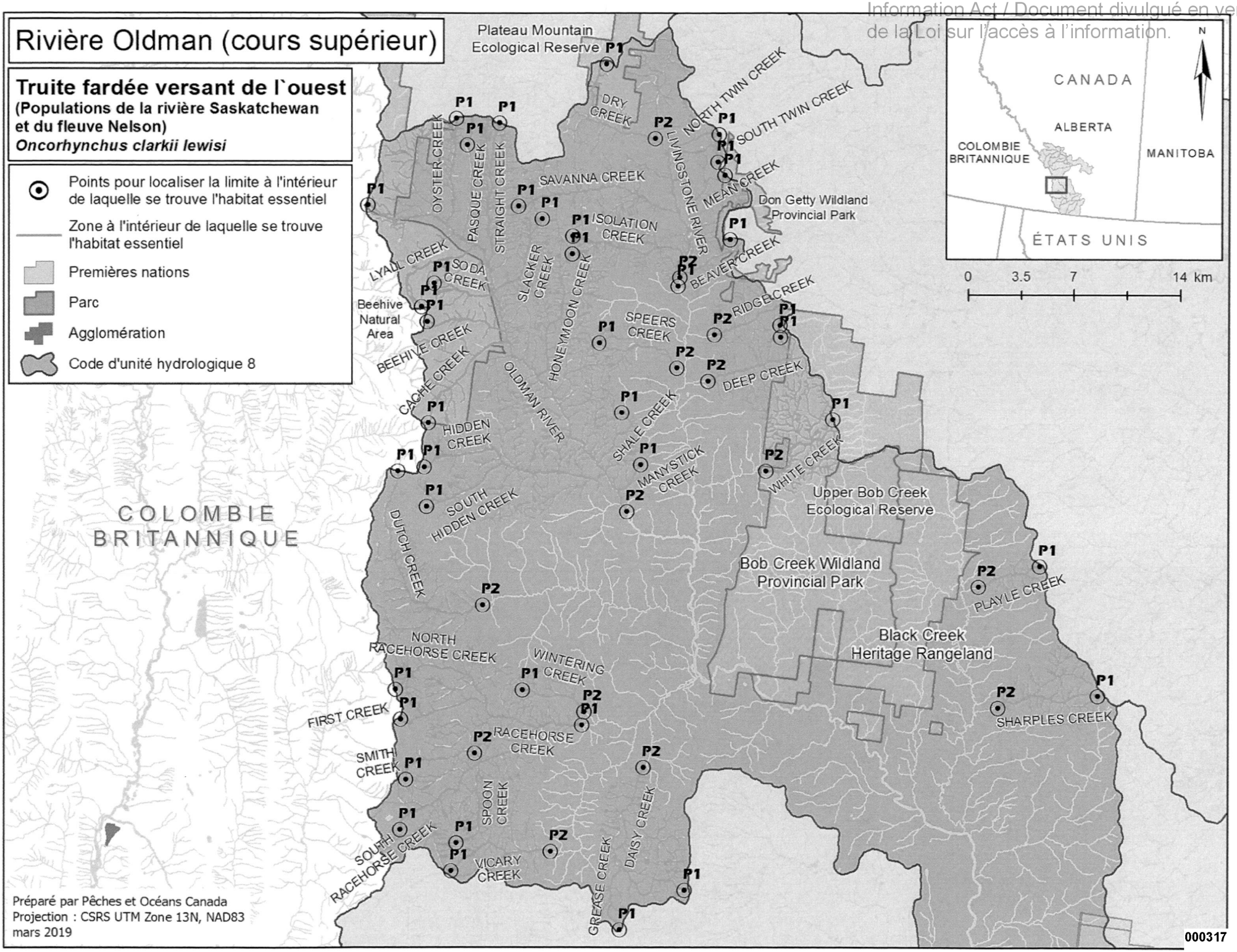


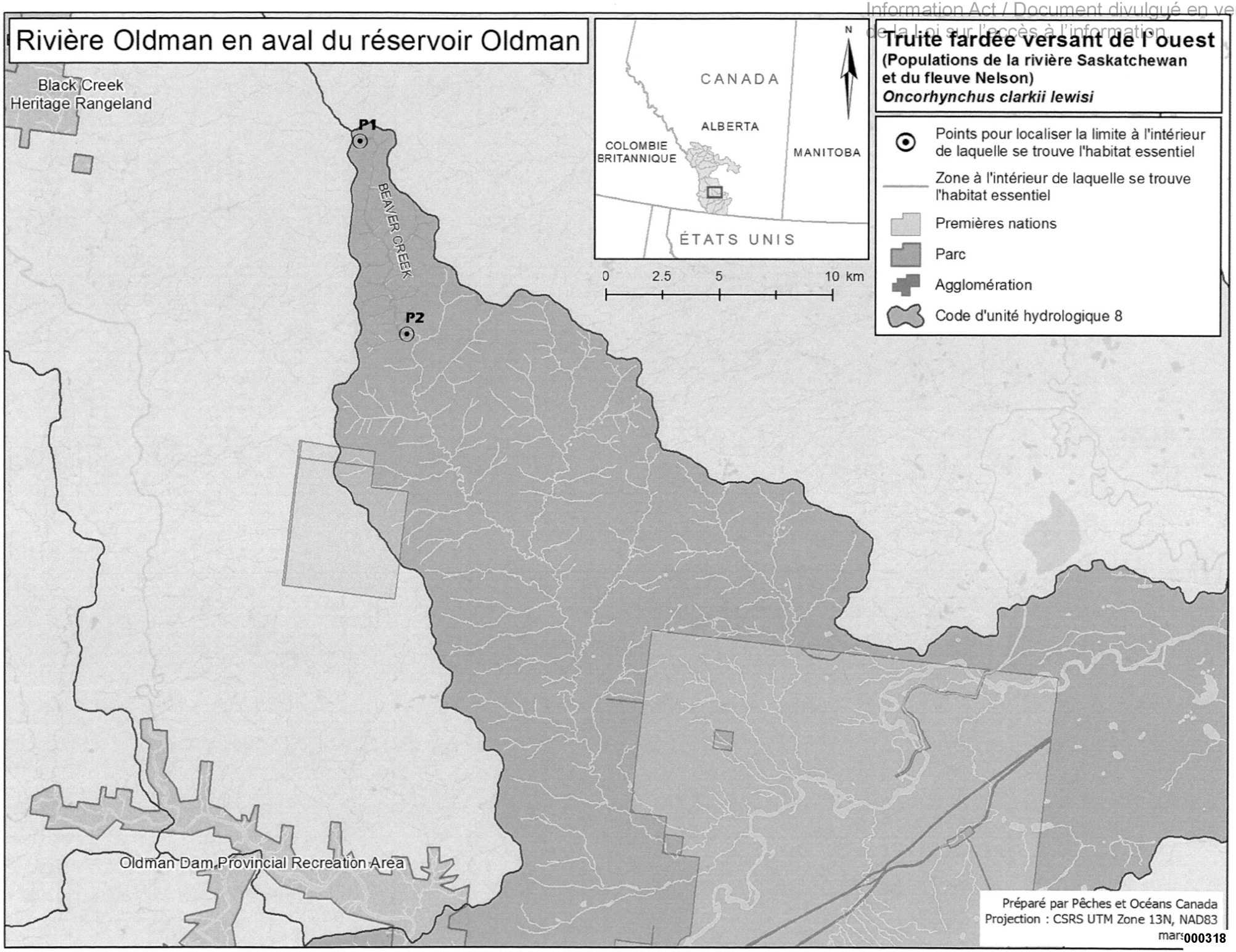


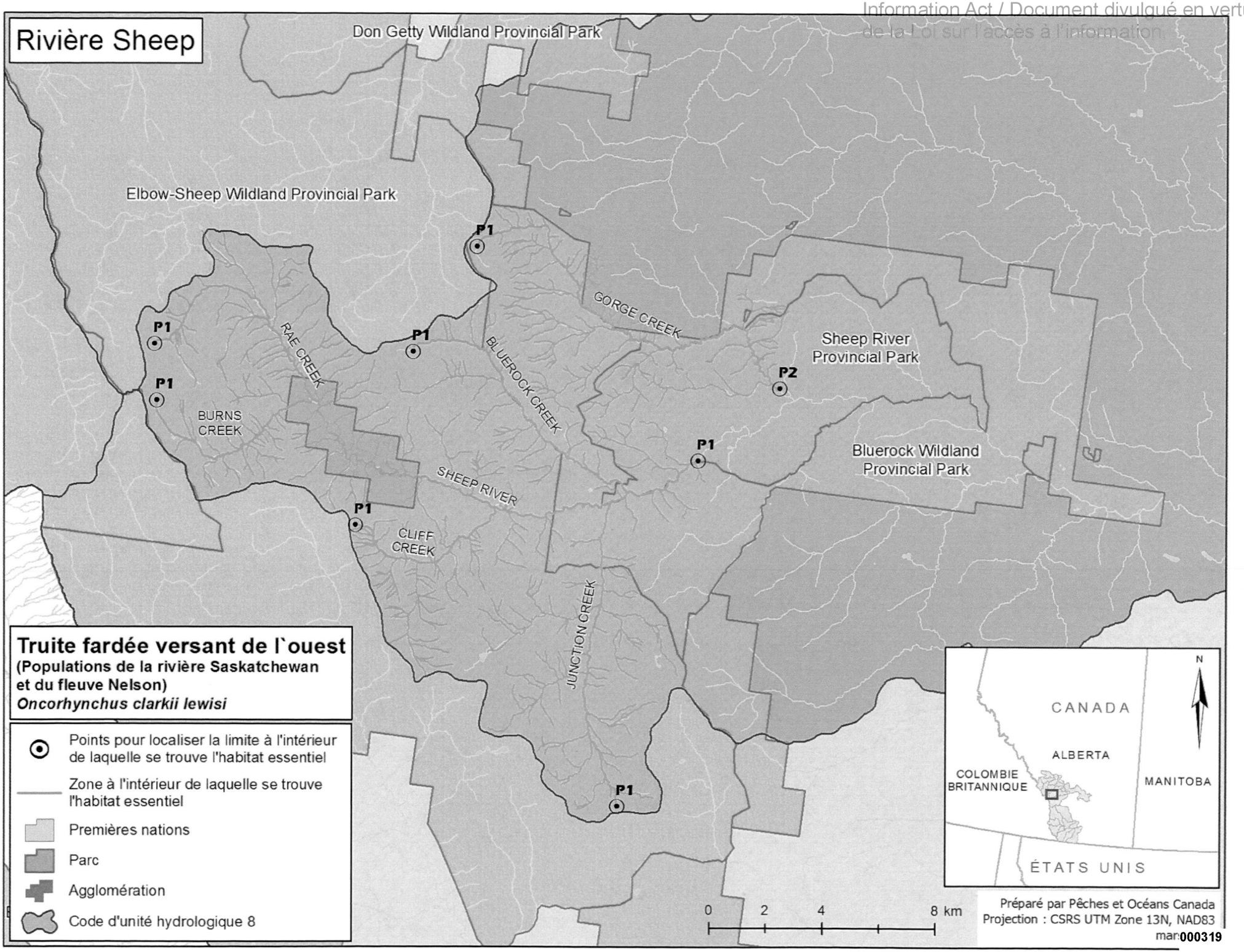


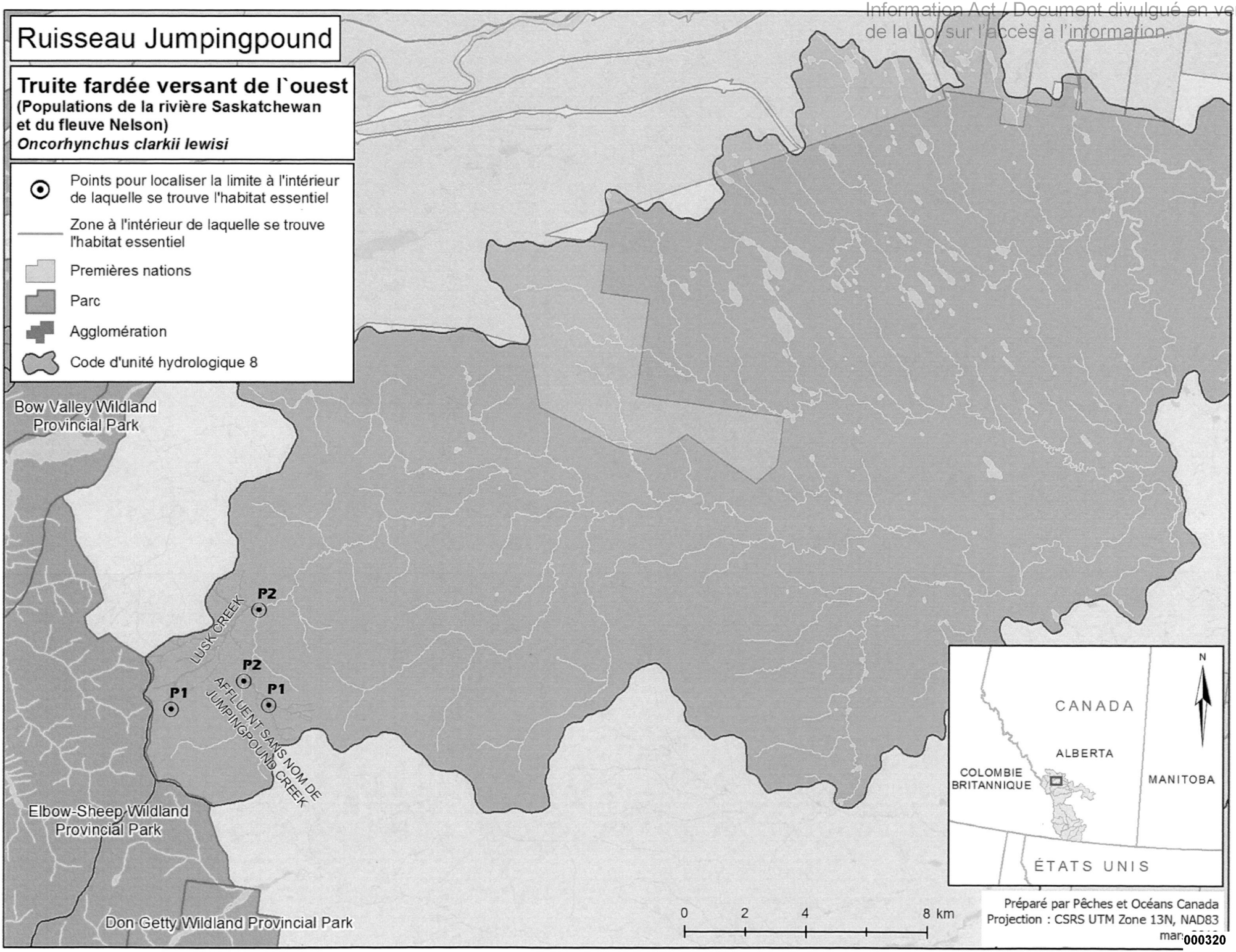




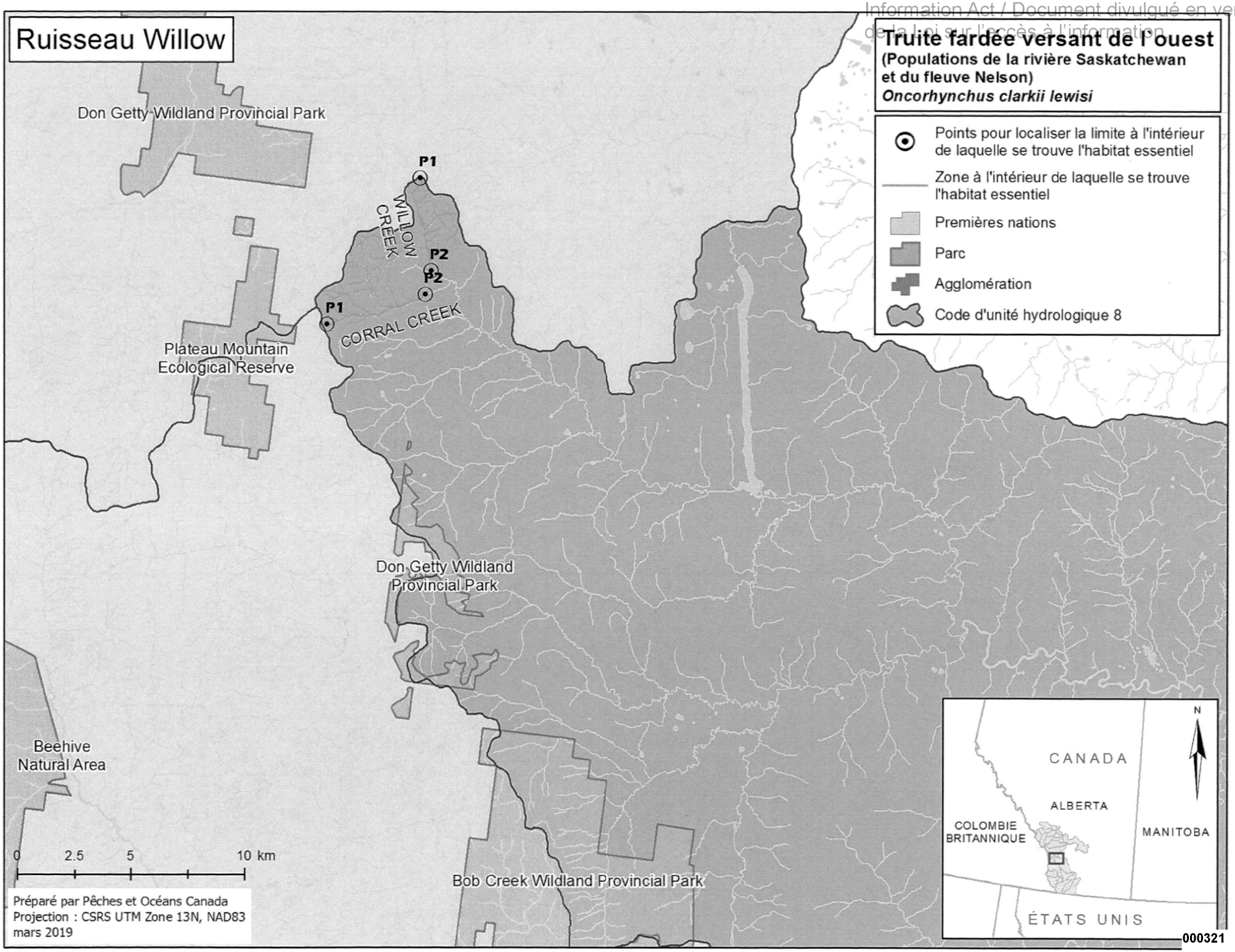




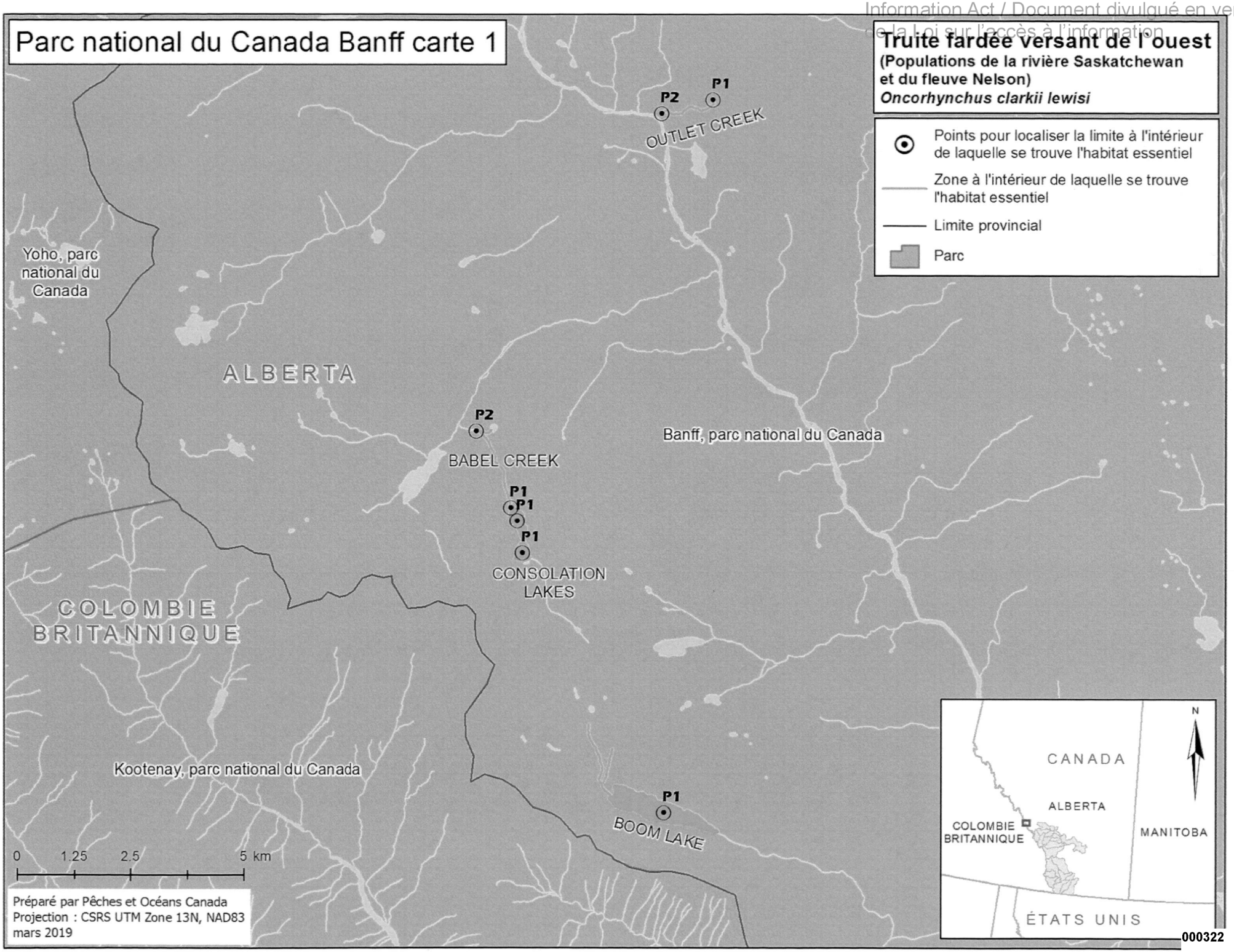




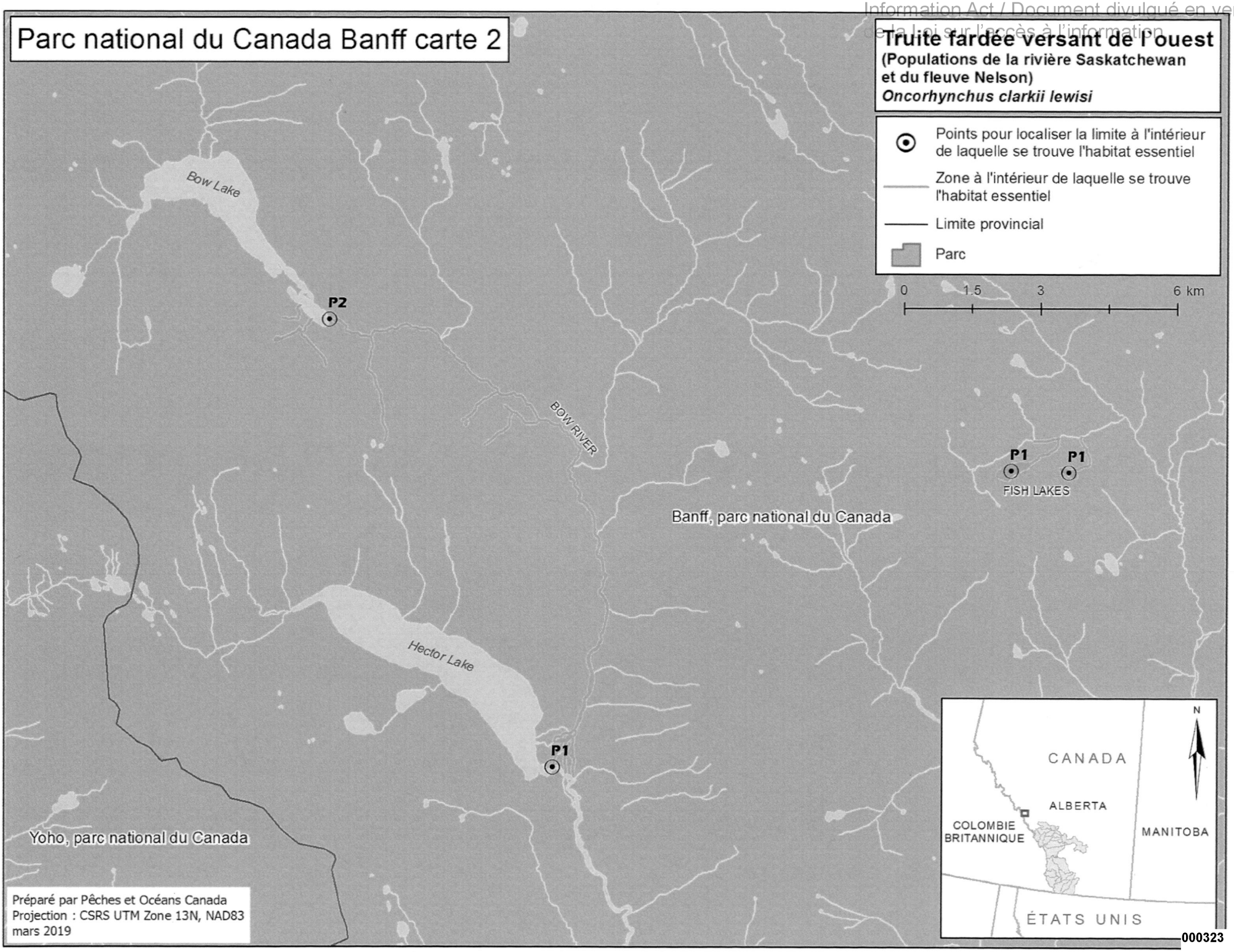
000320



000321



000322



Parc national du Canada Banff carte 3

Truite fardée versant de l`ouest
(Populations de la rivière Saskatchewan et du fleuve Nelson)
Oncorhynchus clarkii lewisi

- Points pour localiser la limite à l'intérieur de laquelle se trouve l'habitat essentiel
- Zone à l'intérieur de laquelle se trouve l'habitat essentiel
- Parc
- Agglomération
- Code d'unité hydrologique 8

0 3 6 12 km

P1 CUTHEAD CREEK
P2
P2
P1
SAWBACK CREEK
P1
P1
SAWBACK LAKE
P1
P2
STONY CREEK
Banff, parc national du Canada
Ghost River Wilderness Area
Don Getty Wildland Provincial Park
P1
MYSTIC LAKE
P1
ELK LAKE
FORTY MILE CREEK
Lake Minnewanka
P2 P1
WHISKEY CREEK

Préparé par Pêches et Océans Canada
Projection : CSRS UTM Zone 13N, NAD83
mars 2019

000324

Parc national du Canada Banff carte 4

Truite fardée versant de l`ouest
(Populations de la rivière Saskatchewan et du fleuve Nelson)
Oncorhynchus clarkii lewisi

- Points pour localiser la limite à l'intérieur de laquelle se trouve l'habitat essentiel
- Zone à l'intérieur de laquelle se trouve l'habitat essentiel
- Limite provincial
- Parc
- Code d'unité hydrologique 8

Banff, parc national du Canada

P2

HEALY CREEK

SUNSHINE CREEK

P1

P1

P1

P1

P1

HEALY LAKES

ALBERTA

Kootenay, parc national du Canada

COLOMBIE BRITANNIQUE

Mount Assiniboine Provincial Park

Préparé par Pêches et Océans Canada
Projection : CSRS UTM Zone 13N, NAD83
mars 2019

0 1.5 3 6 km

000325

Parc national du Canada Banff carte 5

P1
ALLENBY CREEK
MERCER CREEK
Banff, parc national du Canada
Mount Assiniboine Provincial Park
Bow Valley Wildland Provincial Park
Spray Lakes Reservoir
ALBERTA
MARVEL LAKE
MARVEL CREEK
BRYANT CREEK
OWL CREEK
P2
Spray Valley Provincial Park
CURRIE CREEK
WHITE MAN CREEK
WARRE CREEK
BIRDWOOD CREEK
LEVAL CREEK
SPRAY RIVER
Peter Lougheed Provincial Park
COLOMBIE BRITANNIQUE

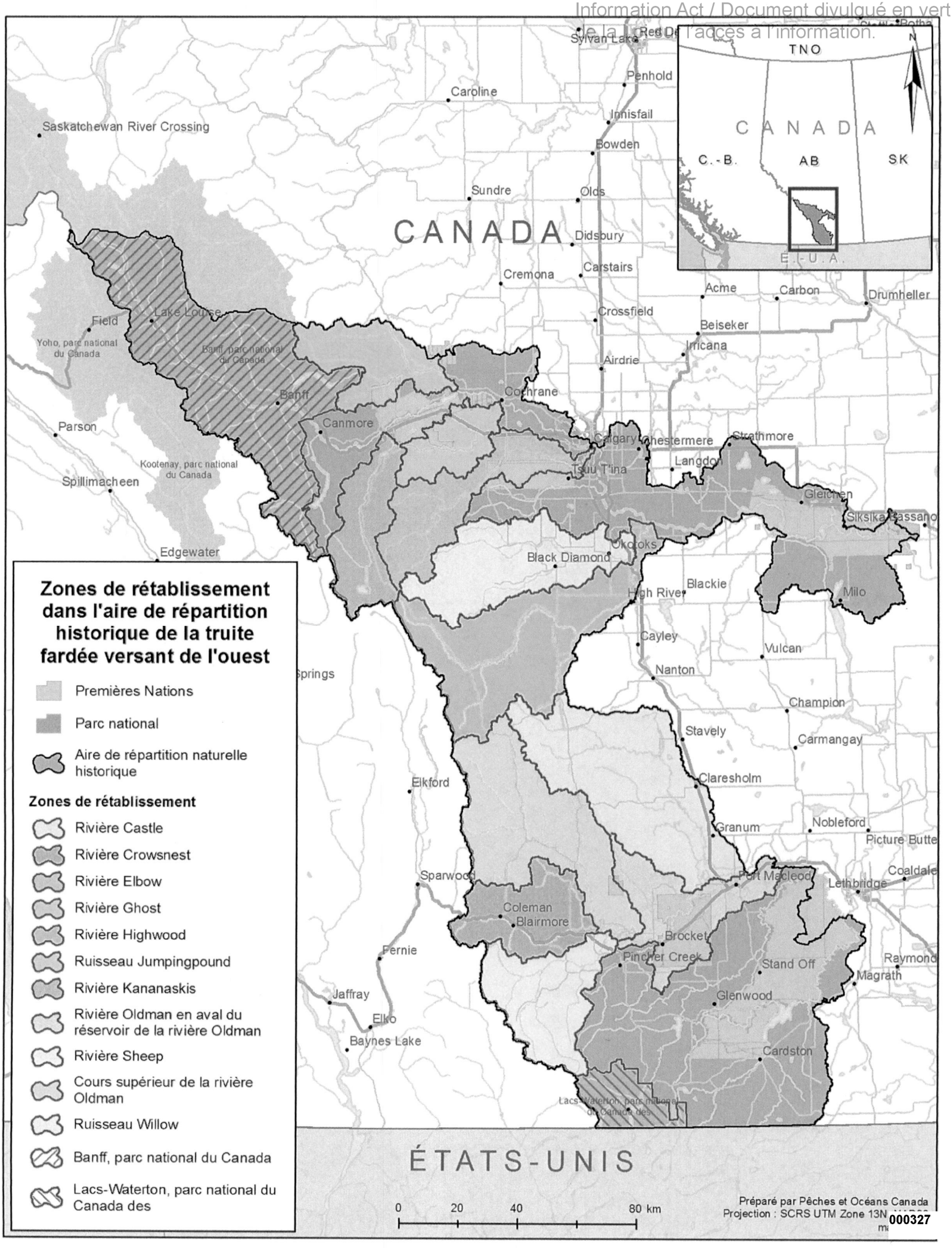
0 2 4 8 km

Truite fardée versant de l`ouest
(Populations de la rivière Saskatchewan et du fleuve Nelson)
Oncorhynchus clarkii lewisi

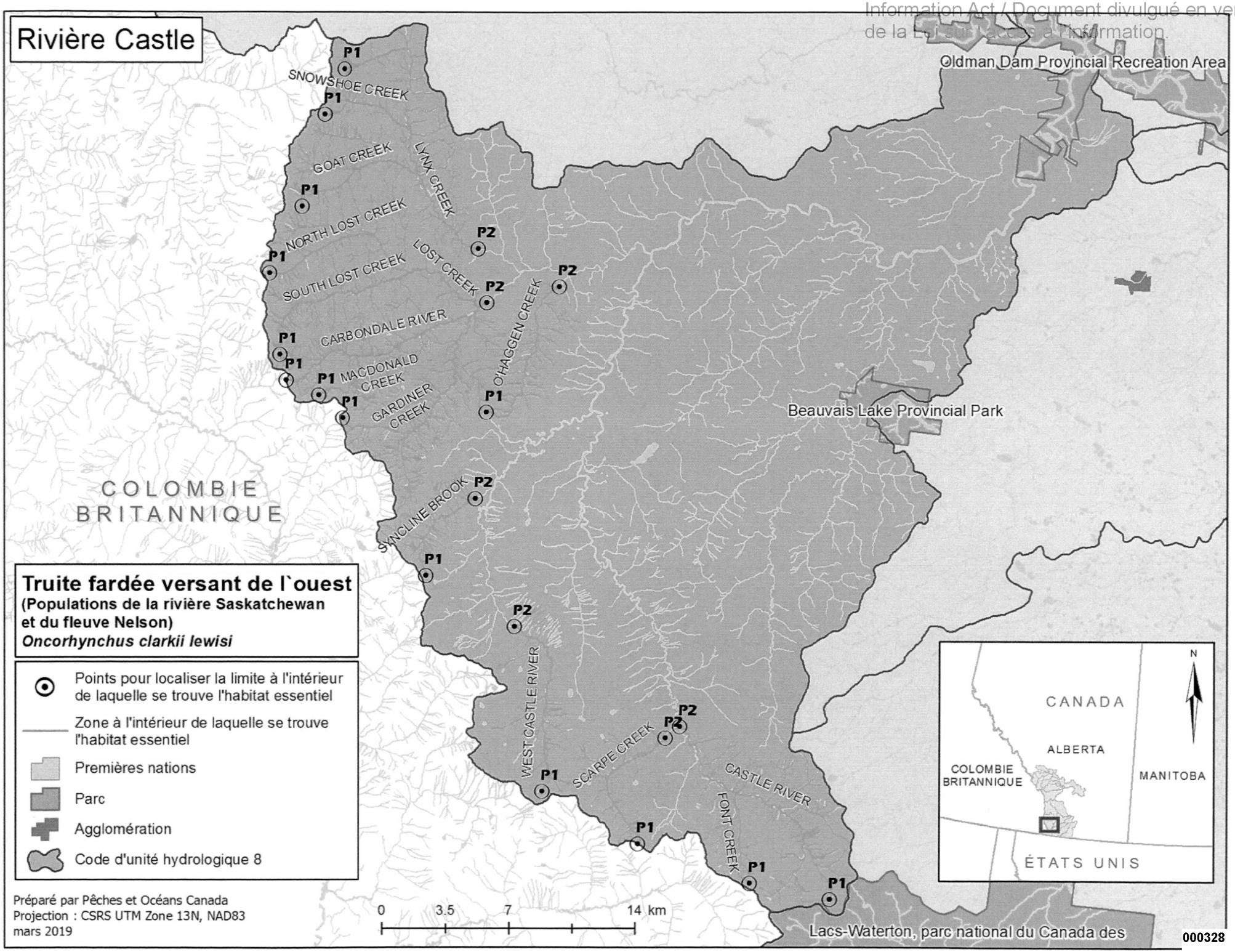
- Points pour localiser la limite à l'intérieur de laquelle se trouve l'habitat essentiel
- Zone à l'intérieur de laquelle se trouve l'habitat essentiel
- Limite provincial
- Parc
- Code d'unité hydrologique 8

Préparé par Pêches et Océans Canada
Projection : CSRS UTM Zone 13N, NAD83
mars 2019

000326



000327



190 232 255

Coordinates that were switched
Syncline Brook
Girardi Creek
Picklejar Creek
Odlum Creek
Etherington Creek
Zephyr Creek
Waiparous Creek added P2 renamed from Ghost R.

New coordinates
Unnamed Tributaries to Rock Creek
Picklejar Lakes 4 and 2